U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-296 272

Mobile Source Emission Factors for Low-Altitude Areas Only

(U.S.) Environmental Protection Agency, Washington, DC

Mar 78

PB 296272

United States
Environmental Protection
Agency

Office of Air
and Waste Management
Washington, DC 20460

EPA-400/9-78-006
March 1978

Air

EPA

Mobile Source Emission Factors

Final Document

For Low-altitude Areas Only

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NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO.
EPA-400/9-78-006

2.

3. RECIPIENT'S ACCESSION NO.
PB296272

4. TITLE AND SUBTITLE
Mobile Source Emission Factors
for Low-altitude Areas Only

5. REPORT DATE
March 1978

6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)
Office of Transportation and Land Use Policy

8. PERFORMING ORGANIZATION REPORT NO.

9. PERFORMING ORGANIZATION NAME AND ADDRESS
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

10. PROGRAM ELEMENT NO.

11. CONTRACT/GRANT NO.

12. SPONSORING AGENCY NAME AND ADDRESS
Same as above

13. TYPE OF REPORT AND PERIOD COVERED
Final Report

14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This document officially revises previous mobile source emission factors which were presented in Supplement No. 5 to AP-42, Compilation of Air Pollutant Emission Factors (December, 1975).

This document does not revise all information in Supplement No. 5. In particular, updated factors are not included for light-duty diesel automobiles, light-duty diesel trucks, off-road sources, or aircraft; nor is any information included on particulates.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution	Carbon Monoxide	Emission Factors	
Automobiles	Nitrogen Oxides		
Light-duty vehicles			
Light-duty trucks			
Motorcycles			
Exhaust emission			
Hydrocarbons			

18. DISTRIBUTION STATEMENT
Release Unlimited

19. SECURITY CLASS *(This Report)*
unclassified

20. SECURITY CLASS *(This page)*
unclassified

21. NO. OF PAGES
200

22. PRICE
MF
PCA09/A01

EPA Form 2220-1 (9-73)

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EPA-400/9-78-006

MOBILE SOURCE EMISSION FACTORS

(For Low-Altitude Areas Only)

Final Document

March 1978

Environmental Protection Agency
Office of Transportation and
Land Use Policy
401 M Street, S.W.
Washington, D.C. 20460

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*** Separately bound report

INTRODUCTION

This document officially revises previous mobile source emission factors which were presented in Supplement No. 5 to AP-42, Compilation of Air Pollutant Emission Factors (December, 1975). In mid-1978 this document will be published as a Supplement to AP-42, at which time additional explanatory material, revised typeset, renumbered tables, and other format changes will be made.

This document does not revise all information in Supplement No. 5. In particular, updated factors are not included for light-duty diesel automobiles, light-duty diesel trucks, off-road sources, or aircraft; nor is any information included on particulates.

AP-42 will be revised periodically via new supplements if measured emission factor values, as determined through in-use vehicle testing programs (assembly line and surveillance testing), and projected emission factors, as estimated from testing of prototype vehicles and from changes to statutory motor vehicle emission standards vary from the estimates contained in this document.

A. Data Sources. To answer the question of how well vehicles perform in actual use, EPA has administered a series of exhaust emission surveillance programs. Test fleets of consumer-owned vehicles within various major cities are selected by model year, make, engine size, transmission, and carburetor in such proportion as to be representative of both the normal production of each model year and the contribution of that model year to total vehicle miles traveled. In the case of heavy-duty vehicles, fuel type and gross vehicle weight were also key items in the stratification scheme.

The data collected in these programs are analyzed to provide mean emissions by model-year vehicle in each calendar year, change in emissions with the accumulation of mileage, change in emissions with the accumulation of age, percentage of vehicles complying with standards, and effect on emissions of vehicle parameters (engine displacement, vehicle weight, etc.). These surveillance data, along with prototype vehicle test data, assembly line test data, and technical judgment, form the basis for the existing and projected mobile source emission factors presented in this document.

The most recently published results of the emission factor program are available in a summary report, 'Automobile Exhaust Emission Surveillance Analysis of the FY 1974 Program', EPA-460/3-76-019, Environmental Protection Agency, OMSAPC/ECTD, Ann Arbor, Michigan 48105. Both the EPA emission factor surveillance program and the EPA regulatory program depend on a valid test procedure over which representative urban emissions can be measured. At the present time, EPA has two test procedures: one for light-duty vehicles (LDVs)--including cars, light trucks, and motorcycles--and one for heavy-duty vehicles (HDVs). These procedures are discussed in subsequent chapters.

For localized pollutants such as CO, the ability of the test procedure to predict changes in emissions depends on the similarity of the localized driving pattern and associated operating conditions to those in the test procedure. The EPA therefore has developed a series of correction factors to expand upon the LDV and HDV test procedures and to predict emissions from a large number of user-specific scenarios. Data required to develop these correction factors have been generated using carefully designed statistical studies which test consumer-owned vehicles.

B. Purpose. This current revision to previous mobile source emission factors is necessary for several reasons:

1. These numbers reflect test data from a much larger sample of in-use vehicles in all vehicle categories than was available previously.
2. New data on catalyst-equipped (post-1974) automobiles are available, requiring significant revision of previously projected emission factors.
3. Additional correction factors and revised correction factors for a wider range of conditions are now available.
4. EPA has promulgated new standards for light-duty trucks, heavy-duty vehicles, motorcycles, and light-duty vehicle and light-duty truck evaporative emissions.
5. Vehicle emission standards for several vehicle categories have been revised by the Clean Air Act Amendments of 1977 (Public Law 95-95).

C. Principal Changes. Both the format and the content of this document differ from AP-42, Supplement No. 5, in several ways:

1. Both actual and projected emission factors are presented in one table for all calendar years for each pollutant. Previously, this information was presented in separate tables for each calendar year. The revised tables should be easier to use.

2. In addition to tabled emission values, the equations used to generate the tables are included to increase the ease of automating the emission inventory process.

3. All vehicles are no longer assumed to travel 10,000 miles per year. Instead, the national average mileage accumulation rates are used, resulting in vehicle miles traveled (VMT) greater than 10,000 miles per year for newer vehicles and decreasing mileage accumulation as vehicles age.

4. Deterioration of exhaust emissions is assumed to continue beyond the first ten years of the vehicle's operating life.

5. The emission standards for each model year vehicle and the derivation of appropriate emission rates are given in appendices.

6. Emission factors specific to California and high-altitude areas are contained in separate parts of this document.

7. The previous equation for computing a light-duty vehicle composite exhaust emission factor (E) given by:

   $$E = SUM(CMVZP)$$

   where the notation SUM(..) represents summation over model year, has remained basically the same (as defined in AP-42, Supplement No. 5) with the addition of several (optional) correction factors and a single correction factor relating speed, ambient temperature, and hot/cold vehicle operation. The revised equation is given by:

$$E = \mathrm{SUM}(CMPALUH)$$

where:

C = the 1975 Federal Test Procedure mean emission factor
M = fraction of total mileage
P = temperature, speed, hot/cold correction factor
A = air-conditioning correction factor
L = vehicle load correction factor
U = trailer towing correction factor
H = humidity correction factor

The revised equation is described fully in Chapter I.

8. The general equation format also has changed for each of the other motor vehicle categories. These revised equations are discussed in each chapter.

9. A single correction factor (P) relates ambient temperature, vehicle speed, and the hot/cold operating mode mix for light-duty vehicles, light-duty trucks, and motorcycles.

10. Correction factors are now available for a wider range of speed and temperature conditions.

11. Idle emission rates are given for all vehicle categories.

12. The modal emission model (which is discussed in Supplement No. 5) is not treated in this document, but is treated in other EPA reports.(1)

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(1) *Automobile Exhaust Emission Modal Analysis Model*, United States Environmental Protection Agency, Office of Mobile Source Air Pollution Control, Report No. EPA-460/3-74-005, January 1974; and *Guidelines for Air Quality Maintenance Planning and Analysis*, Volume 9: *Evaluating Indirect Sources*, U.S. E.P.A., Office of Air Quality Planning and Standards, Report No. EPA-450/4-75-001, January 1975. An update report on the modal model is available from CAB/OMSAPC, Environmental Protection Agency, 2565 Plymouth Rd., Ann Arbor, Michigan 48105.

D. __Organization.__ Chapters I through V provide emission factors for each vehicle category: light-duty, gasoline-powered vehicles (automobiles); light-duty, gasoline-powered trucks; heavy-duty, gasoline-powered vehicles (trucks and buses); heavy-duty, diesel-powered vehicles (trucks and buses); and motorcycles.

Each chapter provides information for use in all areas except California and high-altitude; those emission factors are contained in separate parts of this document.

The equations for computing a composite emission factor and for computing individual correction factors are presented in each chapter.

Computation of all correction factors and composite emission factors is sufficiently complex and time-consuming that a computer program should be used. A computer program for using these emission factors can be obtained from the Office of Transportation and Land Use Policy, AW-445, EPA, 401 M St., S.W., Washington, D.C. 20460.

E. __Relation to Vehicle Inspection/Maintenance.__ If a motor vehicle inspection/maintenance (I/M) program is in effect in the area for which emissions are being calculated, emissions reduction credit can be taken.

A methodology for determining I/M credit was contained in the proposed revision of Appendix N to 40 CFR Part 51 (see 42 __Federal Register__ 22177, May 2, 1977). Appendix N gives credits for all gasoline-fueled sources (light-duty vehicles, light-duty trucks, heavy-duty vehicles, and motorcycles). A final revision to Appendix N will be published in early 1978.

Emission reduction credit attributable to an I/M program will vary according to the type of program in effect, depending on: the stringency factor for determining the emission level for passing or failing tested vehicles; the calendar year of interest and calendar year when I/M was first implemented; the presence of an adequate program of mechanic training; subsequent years of I/M program operation; and frequency of inspections.

The computer program available from EPA includes the capability to apply I/M credits to emissions estimates.

F. Reactive vs. Non-reactive Hydrocarbon Emissions.

Available scientific evidence indicates that methane and a few other non-reactive organic compounds do not contribute to violations of ambient oxidant standards. EPA's Volatile Organic Compound policy, published in the *Federal Register* on July 8, 1977, allows a limited number of compounds, including methane, ethane, Freon 113, and methyl chloroform, to be excluded from control actions. States have been advised that they should exclude these compounds from the baseline emission inventories that are to be used for control strategy development for photochemical oxidants.

Although motor vehicles are regulated directly by the Clean Air Act on a total hydrocarbon basis (rather than on a "reactive" hydrocarbon basis), it is appropriate when estimating ambient oxidant levels to consider only those motor vehicle emissions which will react to form oxidants. However, consideration must be given to the format of any associated stationary source emission inventory so that mobile source and stationary source emission inventories are consistent.

Prior to the introduction of catalyst technology, virtually all (95% or greater) mobile source emissions were considered reactive. With present and future catalyst technology, the methane (i.e., non-reactive) fraction of total hydrocarbon emissions is increasing significantly. The best estimates of the methane percentages applicable to each vehicle category are as follows:

LDV Exhaust, pre-1975	5%
LDV Exhaust, post-1974	15%
LDV Exhaust, Diesel	2%
LDT Exhaust, pre-1975	5%
0-6K LDT Exhaust, Post-1974	15%
6-8.5K LDT Exhaust, 1975-1978	5%
6-8.5K LDT Exhaust, post-1978	15%
Gasoline HDV Exhaust, pre-1983	5%
Gasoline HDV Exhaust, post-1982	15%
Diesel HDV Exhaust, all years	2%
Evaporative Emissions, all years and sources	0%
Crankcase Emissions	0%
Motorcycle Emissions - 2 stroke	1%
Motorcycle Emissions - 4 stroke	5%
Gas Turbine Emissions	5%

While the computer program available from EPA permits the calculation of either total or non-methane hydrocarbon emissions, all HC emission factors are presented in this document as total hydrocarbons.

Chapter I

LIGHT DUTY VEHICLES

A. Introduction. Because of their widespread use, light-duty vehicles (automobiles) are responsible for a large share of air pollutant emissions in many areas of the United States. Substantial research effort has been expended to accurately characterize emissions from these vehicles. EPA's Emission Factor Program (EFP) was instituted a number of years ago in order to estimate emission levels of in-use vehicles for area-wide urban scenarios.

In addition to the methodologies presented for calculating CO, HC, and NOx exhaust emissions, data are given later in this chapter for emissions in the idle mode and for crankcase and evaporative hydrocarbon emissions.

The method for determining composite automobile emission factors, based on the Federal Test Procedure (FTP), is a modification of the procedure that was discussed in earlier editions of AP-42. Emissions testing of light-duty vehicles currently is performed according to the 1975 FTP as stipulated in the Federal Register (Vol 137, No. 211, November 15, 1972). The FTP conditions under which light-duty vehicles were tested are as follows:

1. Ambient temperature = 75°F average (68°F-86°F)
2. Absolute humidity = 75 grains
3. Average speed = 19.6 mph, 18% idle operation
4. Average cold operation = 21%
5. Average hot start operation = 27%

6. Average stabilized operation = 52%
7. Air-conditioning not in use
8. Car contains driver only; no passengers, luggage, etc.
9. Car is not pulling a trailer
10. Vehicles are not in an Inspection/Maintenance program
11. Vehicles receive typical in-use maintenance

The FTP for light-duty vehicles can be briefly described by the following:

1. Determine weight of vehicle.
2. Determine road-load (assuming level road, no curves, no wind) - function of weight and frontal area.
3. Precondition vehicle (i.e., vehicle is briefly driven).
4. "Soak" vehicle for 12 hours at 68°F-86°F.
5. Push vehicle onto a dynamometer.
6. Start test.
7. First 505 seconds collected in bag #1. Mileage = 3.59 miles. Average speed = 25.6 mph.
8. Next 870 seconds collected in bag #2 (Engine is not turned off). Mileage = 3.91 miles. Average speed = 16 mph.
9. Motor is turned off.
10. Car is "soaked" 10 minutes.
11. Car is restarted and the first 505 seconds are rerun and collected in bag #3.
12. The grams of pollutant are determined for each bag.
13. NOx is corrected for humidity.
14. The FTP gm/mile value is computed.

B. As mentioned in the Introduction, the calculation of composite exhaust emission factors using the complete FTP method is given by:

Enpstwx = SUM(Cipn*Min*Ripstwx*Aip*Lp*Uipw*Hip)

where all lower case letters are subscripts and:

SUM( ) = summation over model year (i), from the calendar year for which emission factors are being calculated (i=n) to the calendar year 19 years previous (i=n-19).

Enpstwx = Composite emission factor in gm/mi for calendar year n, pollutant p, average speed s, ambient temperature t, fraction cold operation w, and fraction hot start operation x.

Cipn = The FTP (1975 Federal Test Procedure) mean emission factor for the ith model year light-duty vehicles during calendar year n, and for pollutant p.

Min = The fraction of annual travel by the ith model year LDVs during calendar year n.

Ripstwx = The temperature, speed, and hot/cold correction factor for the ith model year LDVs for pollutant p, average speed s, ambient temperature t, fraction cold operation w, and fraction hot start operation x.

Aip = The air-conditioning correction factor for the ith model year LDVs, for pollutant p.

Lp = The vehicle load correction factor for pollutant p.

Uipw = The trailer towing correction factor for the ith model year LDVs, for pollutant p, and for fraction of cold operation x.

Hip = The humidity correction factor for the ith model year LDVs, for pollutant p.

Computation of all factors for the complete composite exhaust emission factor equation should be computerized for all practical purposes. A computer program is available from EPA's Office of Transportation and Land Use Policy, 401 M St., S.W., Washington, D.C. 20460.

C. Pollutant emission factors for light-duty vehicles. The FTP mean emission factors are given in Tables I-2 through I-4. These emission factors represent average emission factors for July of the calendar year.

The two emission values needed to estimate the emission rates--the zero mileage emission rate and the deterioration rate (per 10,000 miles)--are listed in Table I-1 for different emission control technology categories.

Each LDV emission rate is calculated from a linear mathematical function:

$$Cipn = Aip + Bip*Yin$$

where all lower case letters are subscripts and:

Cipn = the FTP (1975 Federal Test Procedure) mean emission factor, in gm/mi, for ith model year LDVs in calendar year n, and for pollutant p.

Aip = the zero mileage exhaust emission rate of pollutant p, in gm/mi, for ith model year LDVs.

Bip = the emission deterioration rate per 10,000 miles, of pollutant p, for ith model year LDVs.

Yin = the cumulative mileage of ith model year LDVs in calendar year n, divided by 10,000.

Explanations of the appropriate vehicle emission standards and of the derivation of emission rates can be found in Appendices D and E, respectively.

Table I-5a presents the average cumulative mileages for LDVs by age, on July 1. The numbers in this table are derived from the mileages presented in Table I-5, using the methodology presented in Appendix G.

D. Travel Weighting Factor. A sample calculation of this variable is presented in Table I-5. In this sample, nationwide statistics, averaged over five years between 1970 and 1976, are used and the fraction of in-use vehicles by model year (vehicle age) is weighted on the basis of annual miles driven. The calculation may be "localized" to reflect local (county or state) vehicle age mix, annual miles driven, or both. Otherwise, these national data may be used. Table I-5 is assumed applicable to projections as well as existing situations.

E. Speed-Temperature-Hot/Cold Correction Factor. The emission factors found in Tables I-2 through I-4 may be used directly in calculating emissions for scenarios matching those in the Federal Test Procedure (FTP). As described earlier, the FTP describes an average ambient temperature of 75°F, a particular mix of cold, hot stabilized, and hot transient operation, and specific average speeds associated with each of these modes. If emission calculations are desired for scenarios matching these FTP conditions, no correction would be necessary, i.e., a value of 1.0 can be used for any correction factor if better information is not available.

For scenarios which vary from the FTP conditions, correction factors are desirable. The correction factor for ambient temperature, average speed, and percentage hot and cold operation represents a major change from the previous treatment in Supplement 5 to AP-42. The interdependence of these variables has led to their expression as a single correction factor, rather than as separate correction factors. The new factor is identified by the term Pipstwx in the composite exhaust emission equation.

The FTP measures emissions during three phases of operation. A cold transient phase is representative of vehicle start-up after a long engine-off period; a stabilized phase is representative of warmed-up engine operation; and hot-start vehicle operation occurs in the first 505 seconds of vehicle start-up after a short engine-off period. The cold, hot, and stabilized phases are 21%, 27%, and 52%, respectively, of the total FTP mileage.

For non-catalyst vehicles, the cold vehicle operation phase is defined as the first 505 seconds of vehicle operation following a 4-hour engine off period. For catalyst vehicles the cold operation phase is defined as the first 505 seconds of vehicle operation following a 1-hour engine-off period. If the engine-off period ('soak time') is less than 4 hours for non-catalyst vehicles or less than 1 hour for catalyst vehicles, the restarted vehicle is considered to be in a hot operating mode. More specific information on the relationship between cold vehicle operation, 'soak time', and ambient temperature may be obtained from EPA's Office of Transportation and Land Use Policy.

In those situations where the percentage of cold, stable, and hot vehicle operation do not match the FTP percentages (i.e., 21%, 52%, and 27%), emission factors may be corrected to account for the actual percentage of total mileage in each operating mode. Knowledge of the percent VMT in each mode is especially useful for microscale analyses in which these percentages can vary greatly within any urban area as well as diurnally. One methodology used to determine the appropriate cold mode percentages may be found in the EPA report: Determination of Percentages of Vehicles Operating in the Cold Start Mode, EPA-450/3-77-023, August 1977, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711.

During the FTP emissions are collected in bags according to these three phases of operation. Bag 1 represents the emissions sampled under cold start conditions with an average speed of 26 mph; Bag 2 represents emissions sampled under stabilized conditions with an average speed of 16 mph; and Bag 3 represents emissions sampled under hot start conditions with an average speed of 26 mph.

In those situations where the bag-specific average speeds do not match those of the FTP, it is necessary to correct the average speed. The speed correction factors are incorporated into the correction factors for temperature-hot/cold weighting rather than being given as separate factors. The reason for this incorporation stems from the assumption that the effect of speed on emissions is bag-specific. The resulting formulas for HC, CO, and NOx are presented in Table I-6.

Although the speed correction factors are incorporated into the Ripstwx formulas, selected speed correction factors are given in Appendix A: (1) for general information, and (2) to permit comparison with speed correction factors which can be generated for any speed from the normalized equations given in Appendix B.

Data used to develop the Ripstwx values were provided by five sources:

(1) the study Ambient Temperature and Vehicle Emissions (EPA 460/3-74-028, October 1974) in which FTP emissions tests were performed on 1967-1975 model year non-California cars at ambient temperatures of 20°F to 110°F;

(2) data from the Environmental Protection Service, Ottawa, Canada, on FTP tests of 1975 cars meeting either the federal standards or the more stringent California emission standards;

(3) EPA's annual Emission Factor Program, which tests in-use vehicles in seven cities across the country;

(4) the 1970 Vehicle Operations Survey; and,

(5) the 1974 GM Chase Car Survey.

Applicability of correction factors. The general correction factors are applicable to ambient temperatures of 0°F to 110°F, speeds of 5 to 60 mph, and all combinations of hot/cold driving. Also, the factors should only be applied to transient driving situations. To predict the emissions of a steady-state (i.e., constant speed) driving sequence such as constant 20 mph operation, the modal analysis model should be applied to the specific speed of interest and/or EPA surveillance reports should be referenced. The difference between emissions measured over steady state and transient cycles is considerable at low average speeds (greater than 20%) and becomes negligible at speeds of approximately 45 mph. For further information on the modal analysis model, see the footnote on p. 5.

For regional modeling, urban and rural emission projections should be performed separately to minimize the chance of introducing major errors which might result from incorrectly applied speed correction factors. Obviously, every vehicle on a road link will not have the same average speed; there will be a range of speeds. If (1) a speed correction factor is applied to model the average emission on a road link, (2) the correction factor is linear within this range, and (3) traffic is symmetrically distributed around the average speed, then the application of a single correction factor is appropriate. The same situation exists in modeling regional emission levels. However, the extent to which this assumption of symmetry is satisfactory is not known at the present time. Thus, it would be prudent to apply separate models to project urban emission levels and rural emission levels.

Comparisons with Supplement 5 Factors. Supplement 5 ambient temperature-hot/cold correction factors for pre-1975 and 1975 model year cars, respectively, were compared with the revised factors for pre-controlled 1968-1974, 1975 Federal, and 1975 California model year vehicles. For these comparisons, average speed was assumed equal to FTP average speed conditions. Comparisons indicate that under severe temperature-%hot/%cold conditions, Supplement 5 correction factors for HC and CO are substantially higher than the revised factors, and that under mild conditions, Supplement 5 factors are substantially lower than the revised numbers. For NOx the correction factors are on the same order of magnitude.

F. LDV Correction Factor for Air Conditioning.

The use of air conditioning can have a significant effect on emissions. The following correction factors may be applied to all model years:

Air Conditioning Correction Factors for All Model Years

HC	CO	NOx
1.13	1.18	1.18

In order to apply the air conditioning correction factors, it is necessary to know the percentage of vehicles in the population that are equipped with air conditioning. Data from EPA's FY 74 Emission Factor Program indicate the following percentage by model year. These values include both factory installed and customer installed air conditioning systems. City-specific values may vary considerably from these estimates.

Percentage of Vehicles with A/C by Model Year	
Pre-1966	54%
1966-1968	66%
1969-1972	75%
1973+	81%

In addition, any specific application of air conditioning correction factors should consider the percentage of time that the air conditioning is in use. Adjusted for the local situation, the following equation should be employed:

$$A = (u)(v)(cf - 1.0) + 1.0$$

where:

A = correction factor adjusted for usage level,

u = fraction of vehicles equipped with air conditioning,

v = fraction of vehicles which are equipped with air conditioning, and which have the A/C system in operation, and,

cf = tabled A/C correction factor.

This calculation assumes that vehicles with A/C installed travel the same average mileage per year as do vehicles without A/C installed.

G. Vehicle Loading Correction Factor. The FTP emission factors found in Tables I-2 through I-4 assume an average vehicle loading of 300 pounds, which accounts for the weight of a typical driver, vehicle fuel, and other liquids. There are, however, situations in which vehicles have higher passenger/luggage loading.

To apply the vehicle loading correction factors found in Table I-9 to a specific situation, it is necessary to have an estimate of the percentage of total vehicles which are operating under an additional 500 pounds condition because they are heavily occupied with people or baggage. The actual correction factor adjusted for the usage level also is given in Table I-9.

Although these factors are specific to the 500 pound weight load, interpolation between 300 pounds and 800 pounds is acceptable.

H. Trailer Towing Correction Factor. The FTP emission factors found in Tables I-2 through I-4 represent circumstances in which the vehicle is not towing a trailer. This section discusses the correction factors for vehicles which are towing trailers.

A discrete weight point was selected for testing the influence of trailer towing on vehicle emissions. This point is 1000 pounds of additional weight. Extrapolation or interpolation of trailer towing correction factors is not appropriate. Table I-10 presents the values for trailer towing correction for all model years prior to 1975. These values result from the averaging of test results for model years 1967 to 1974.

For 1975 and later model years, the correction factor value must be determined by using the equations in Table I-10. The distinction between pre-1975 models and later models is due to the assumption that a large increased load on a catalyst vehicle will result in greater emissions during hot operation than during cold operation. The additional load is expected to result in rich operation, reducing the oxygen available to the catalyst and thereby increasing emissions.

I. __Humidity Correction Factor.__ The NOx tabled emission factors are normalized to 75 grains of water per pound of dry air. In order to correct NOx emissions under different humidity conditions, the formula for the correction factor is given below, and is applicable for all model years:

Humidity Correction Factor for NOx
$C.F. = 1.0 - .0047(H - 75.)$ where: H = humidity(gr/lb)

If the appropriate humidity information is not available, the correction factor defaults to a value of 1.0.

J. __Idle Emission Factors for LDVs.__ Estimates of emissions during a vehicle's idle operating mode may be appropriate at trip attractions such as shopping centers, airports, sports complexes, etc. Because idle emission factors are expressed in units of emissions per unit time, emissions at idle are estimated using vehicle operating minutes rather than the conventional vehicle-miles-of-travel.

Light-duty vehicle idle emission rates are calculated from the initial emission rates and deterioration rates given in Table I-7. The emission rates in grams/minute at age Y are given by the tabled values; where the first term of any quantity of the form a + bY is the initial emission rate (at age zero), and the coefficient of the second term is the deterioration, expressed in units of grams per minute per 10000 miles.

K. Crankcase and Evaporative Emission Factors. In addition to exhaust emission factors, the calculation of hydrocarbon emissions from gasoline vehicles involves evaporative and crankcase hydrocarbon emission factors. The two major sources of evaporative hydrocarbon emissions from light-duty vehicles are the fuel tank and the carburetor system. Diurnal changes in ambient temperature result in expansion of the air-fuel mixture in a partially filled fuel tank. As a result, gasoline vapor is expelled to the atmosphere. Running losses from the fuel tank occur as the fuel is heated by the road surface during driving, and hot-soak losses from the carburetor system occur after engine shutdown at the end of a trip.

Previous editions of AP-42 contained several equations and emission factors for computing crankcase and evaporative hydrocarbon emissions. Since crankcase hydrocarbon emissions from post-1963 vehicles are negligible, only one emission factor and one equation are presented. These values are determined from data collected in the emission factor programs. Future rates are based on the assumption that standards currently in the regulatory process will be implemented and that the vehicles will meet the standards throughout their useful life. Crankcase and evaporative emissions are not assumed to deteriorate as vehicles age.

Composite evaporative and crankcase emissions can be determined using:

$$Fn = SUM(Hi*Min)$$

where all lower case letters are subscripts and:

Fn = The composite crankcase and evaporative hydrocarbon emission factor for calendar year n,

Hi = The crankcase and evaporative emission factor for the ith model year, and

Min = The weighted annual travel of the ith model year during calendar year n.

Crankcase and evaporative hydrocarbon emission rates by model year are summarized in Table I-8. The exhaust emission factors in Tables I-1 and I-2 do not include crankcase or evaporative emissions.

Chapter II

GASOLINE-POWERED LIGHT-DUTY TRUCKS

A. Introduction. This vehicle category consists of trucks used chiefly for personal transportation which are powered by gasoline-fueled, spark-ignited internal combustion engines. Two sub-categories of light-duty trucks are used: trucks having a gross vehicle weight (GVW) in the range 0-6000 pounds, and trucks with GVW in the range 6001-8500 pounds. Trucks in these two categories are essentially all two-axle, four tire trucks. Trucks and buses having a GVW above 8500 pounds are defined as heavy-duty vehicles and are discussed in Chapters III and IV. These definitions of light-duty trucks and heavy-duty vehicles are identical to those in AP-42, Supplement 5.

The testing conditions used for the light-duty trucks in the 0-6000 pound range are the same as those in the Federal Test Procedure (FTP) for light-duty vehicles, as discussed in Chapter I. Until the 1979 model year, the trucks in the 6001-8500 pound range are to be certified under the less stringent Heavy-Duty Truck Procedures. In 1979 the testing conditions for both weight ranges will be the same as those currently in effect for light-duty trucks.

B. __Composite Exhaust Emission Equation.__ The composite exhaust emission factor for gasoline-powered LDTs is given by:

$$Enpstw = SUM(Cipn*Min*Ripstwx*Aip*Lp*Hip)$$

where all lower case letters are subscripts and:

SUM( ) = summation over model year (i), from the calendar year for which emission factors are being calculated (i=n) to the calendar year 19 years previous (i=n-19).

Enpstwx = Composite emission factor in gm/mi for calendar year n, pollutant p, average speed s, ambient temperature t, fraction cold operation w, and fraction hot start operation x.

Cipn = The FTP (1975 Federal Test Procedure) mean emission factor for the ith model year light-duty trucks during calendar year n, and for pollutant p.

Min = The fraction of annual travel by the ith model year LDTs during calendar year n.

Ripstwx = The temperature, speed, and hot/cold correction factor for the ith model year LDTs for pollutant p, average speed s, ambient temperature t, fraction cold operation w, and fraction hot start operation x.

Aip = The air-conditioning correction factor for the ith model year LDTs, for pollutant p.

Lp = The vehicle load correction factor for pollutant p.

Hip = The humidity correction factor for the ith model year LDTs, for pollutant p.

C. Pollutant emission factors for light-duty trucks. The zero mileage emission rates and deterioration rates (per 10,000 miles) used to generate the tabled emission factors are listed separately in Tables II-1, II-1a, and II-1b for the 0-6000 pound category, the 6001-8500 pound category, and the combined category. Emission factors for each weight category are given in Tables II-2a through II-4a, and Tables II-2b through II-4b, and composite emission factors which combine the two weight categories of light-duty trucks using the national sales weighting statistics have been calculated for each calendar year by model year and are given by pollutant in Tables II-2 through II-4.

Tables II-5c and II-5d present the average cumulative mileages for LDTs by age, on July 1. The numbers in this table are derived from the mileages presented in Tables II-5a and II-5b, using the methodology presented in Appendix G.

D. Weighting Factors for LDTs. 1. Sales Weighting Factors for LDTs. Table II-10 presents the percentage of 0-8500 pound LDTs in each of the weight categories 0-6000 pounds GVW and 6001-8500 pounds GVW. These percentages may be used to weight the two sets of emission factors in Tables II-2a through II-4b. This weighting was used to generate the emission factors in Tables II-2 through II-4. The percentage distribution by sales is based on naticnal data. 2. Travel Weighting Factor. A sample calculation of this variable is presented in Table II-5. In this sample, nationwide statistics are used, and the fraction of in-use vehicles by model year (vehicle age) is weighted on the basis of the annual rate of mileage accrual. The calculation may be "localized" to reflect local (county or state) vehicle age mix, annual rate of mileage accrual, or both. In situations where local data are not available, the national data may be used. Table II-5 is assumed applicable to projections as well as existing situations.

B. Speed-Temperature-Hot/Cold Correction Factor. Limited data are available for the development of correction factors for light-duty trucks (LDT). Due to the similarity of engine designs and emission control designs, LDTs are expected to behave similarly to LDVs under other than standard FTP conditions. Therefore, the discussion of Pipstwx in Chapter I is applicable to LDTs as well, with the following modifications:

> Tables II-6a and II-6b contain the general formulas for calculating Pipstwx. The two tables differ in that LDT's less than 6000 lbs. have three applicable Pipstwx equations while LDT's greater than 6000 lbs. have only two applicable equations.

F. *Air Conditioning Correction Factor.* Correction factors for air-conditioning, Aip, in light-duty trucks are assumed to be equivalent to the LDV air-conditioning correction factors, as discussed in Chapter I.

G. *Vehicle Loading Correction Factor.* Correction factors for additional load (passenger and/or luggage) of 500 pounds, designated by the term Lp, are assumed to be equivalent to those indicated in Chapter I for LDVs.

H. *Humidity Correction Factor.* The user is again reminded that this correction factor is only relevant to NOx emissions. The correction factor and methodology discussion for LDVs in Chapter I is assumed applicable to LDTs.

I. *Idle Emission Factors for LDTs.* As discussed in Chapter I, there are occasions which arise in which the emissions estimate must reflect the idle operating mode. Idle emission factors are expressed in terms of elapsed time of vehicle operating minutes.

0-6000 lb. Trucks. Idle emission rates for this truck weight category can be calculated from the initial emission rates and deterioration rates in Table II-7a. The emission rates, in gm/minute, are given by the tabled values; where the first term of any quantity of the form a + bY is the initial emission rate (at zero mileage), and the coefficient of the second term is the deterioration in gm/minute per year. Y is the cumulative mileage divided by 10,000 miles.

6001-8500 lb. Trucks. Similarly, the emission rates for this category can be calculated from the initial emission rates and deterioration rates in Table II-7b.

J. *Crankcase and Evaporative Emission Factors.* For a discussion of this topic, refer to Section K in Chapter I. Table II-8 identifies crankcase and evaporative hydrocarbon emission factors by model year.

Chapter III

GASOLINE-POWERED HEAVY-DUTY TRUCKS

A. Introduction. This vehicle category consists of trucks and buses having gross vehicle weights (GVW) of over 8500 pounds and which are powered by gasoline-fueled, spark-ignited internal combustion engines.

EPA test programs for determining in-use heavy-duty vehicle (HDV) emission factors use both the heavy-duty Federal Test Procedure (FTP) and an actual urban road test, the San Antonio Road Route (SARR). The SARR is run under the following conditions:

1. Ambient temperature = 75°F
2. Absolute humidity = 75 grains
3. Average speed = 20 mph
4. Average stabilized operation = 100%
5. Average operating weight = 17K-20K pounds for gas, 40K-50K pounds for diesel.
6. Average weight/CID = 47-54 for gas, 57-67 for diesel.
7. All testing performed in one low-altitude city.
8. Vehicles receive typical in-use maintenance.
9. No I/M program in effect.

The FTP is run at a series of steady-state engine speeds and loads with a hot start and a hot stabilized phase. Since emissions from these tests are not equivalent to on-the-road emissions, regression equations were developed so that on-the-road emissions (SARR) could be predicted.

The San Antonio Road Route (SARR) located in San Antonio, Texas, is 7.24 miles long and includes freeway, arterial, and local/collector highway segments. A constant volume sampler is carried on board each of the test vehicles for collection of a proportional part of the exhaust gas from the vehicle. This sample is later analyzed to yield mass emission rates. Because the SARR is an actual road route, the average speed varies depending on traffic conditions at the time of the test. The average speed tends to be around 20 mi/hr, with about 20% of the time spent at idle. The test procedure emission factor is composed entirely of warmed-up vehicle operation. Based on preliminary analysis of vehicle operation data, almost all heavy-duty vehicle operation is under warmed-up conditions.

At this time, it is not known whether the SARR accurately represents average urban HDV driving patterns. Preliminary analysis of Los Angeles urban truck operation data indicates an average speed of around 26 mph, 6 mph higher than the SARR average speed. Data from other sites have not been analyzed. The road route does have similar characteristics to the representative light-duty driving schedule with respect to average road speed and percent time at idle. Since traffic is likely to be the major constraint within the urban environment, it is not surprising that the truck and car schedules are similar. However, the SARR (and the current LDV FTP) makes no attempt to account for the time that trucks spend idling as a result of deliveries, special operations (buses, garbage trucks), auxiliary power equipment, etc.

Thus, it is possible that the final HD cycle that is developed in future rulemaking will have a higher idle percentage and a lower average speed than the SARR. Since the operational data have not yet been completely analyzed and trucks have not been tested on transient cycles developed from the operational data, the tabled emission factor estimates are based on the SARR driving schedule.

Data were assembled from two major sources:

1. The emission factors contracts involving testing of 35 gasoline and ten diesel in-use heavy-duty trucks by chassis dynamometer versions of the Federal Test Procedure (FTP) as well as over the San Antonio Road Route (SARR).
2. The emission factors (sensitivity study) of 18 gasoline and 12 diesel in-use heavy-duty trucks. These vehicles were also tested by chassis versions of the FTP and over various experimental sequences (both steady state and transient cycles). SARR estimates were obtained by using linear regressions based on data source 1.

Other in-use heavy-duty vehicle and engine data which are available were not incorporated because they were either not sampled using current testing methodology (e.g., gasoline 9-mode concentration data which are not directly convertible to mass emissions) or were collected on potentially non-representative engines (e.g., engines with experimental emission control modifications).

The tabled emission values are based on all available mass emissions data measured over the FTP and converted to SARR estimates by using regression equations.

B. Composite Exhaust Emission Equation. The composite exhaust emission factor for gasoline-powered HDVs is given by:

$$Enpsoq = SUM(Cipn*Min*Vips*Pipnoq)$$

where all lower case letters are subscripts and:

SUM( ) = summation over model year (i), from the calendar year for which emission factors are being calculated (i=n) to the calendar year 19 years previous (i=n-19).

Enpsoq = Composite emission factor in gm/mi for calendar year n, pollutant p, average speed s, truck weight o, and weight/power ratio q.

Cipn = The Federal Test Procedure mean emission factor for the ith model year HDG vehicle in calendar year n, and for pollutant p.

Min = The fraction of annual travel by the ith model year HDG during calendar year n.

Vips = the speed correction factor for the ith model year HDG vehicles, for pollutant p and average speed s.

Pipnoq = the truck characteristic correction factor for the ith model year HDG vehicles for pollutant p, calendar year n, truck weight o, and weight/power ratio q.

C. Pollutant emission factors for HDG. Table III-1 includes the zero-mileage emission rates and the deterioration rates (per 10,000 miles) used to generate the emission factors given in Tables III-2 through III-4.

Table III-5a presents the average cumulative mileages for HDG trucks by age, on July 1. The numbers in this table are derived from the mileages presented in Table III-5, using the methodology presented in Appendix G.

D. Travel Weighting Factor. The nationwide fraction of gasoline-powered, HDV annual travel by model year is shown in Table III-5. Localized data, if available, should be substituted when calculating the variable Min for a specific area under study.

E. Speed Correction Factor for HDG. In part because the SARR may not be representative of an average national driving schedule and in part because a need may exist to determine emissions over localized driving conditions which differ significantly from the average national driving schedules, a correction factor has been developed for average speed. The speed correction factors can be applied between 5 and 55 mph.

As in previous editions of AP-42, the speed correction factors for hydrocarbons and carbon monoxide are computed by

$$Vips = \exp(A + B*S + C*S*S)$$

where e is the base of the natural logarithms (2.718), S is the speed, and A, B, and C are coefficients whose values for various model years are given in Table III-6.

The speed correction factor for NOx is given by:

$$Vips = A + B*S$$

with A and B values also given in Table III-6.

F. Truck Characteristic Correction Factor for HDG.

Adjustment factors also have been developed for heavy-duty vehicle weight and the weight/power ratio. (The surveillance data samples used to generate these correction factors attempt to represent the national distribution of vehicles and therefore represent the national average weight and weight/power values. However, the sample sizes are small. National averages are difficult to determine since they involve a knowledge of actual truck operating weight--not registered weight--and engine displacement. Although the Department of Transportation performs weight surveys, cubic inch displacement (CID) information has not been recorded.

Since the basic heavy-duty vehicle emission factor assumes that the trucks are at half load, this correction factor has been designed to adjust for empty trucks or fully loaded trucks. The weight and weight/CID correction factor was developed for weights ranging from 13000 to 29000 pounds and a CID of 330 to 390 for gasoline-powered vehicles. Correction factors for vehicles beyond these ranges should not be computed unless an engineering evaluation indicates that the form of the equation is appropriate.

The truck characteristic correction factor is computed from the following equation:

$$\text{Pipnog} = b0 + b1(WT/1000) + b2(WT/CID)$$

where:

WT = vehicle weight

CID = engine's cubic inch displacement

b0, b1, and b2 are coefficients given in Table III-9.

When HDV weight and power information is not available (as usually will be the case), this correction factor value should be set equal to one.

G. Idle Emission Factors for HDG. Estimates of gasoline-powered, heavy-duty vehicle idle emission rates for HC, CO, and NOx can be calculated from the information in Table III-7.

H. Crankcase and Evaporative Emission Factors. Hydrocarbon evaporative and crankcase emission rates are given in Table III-8. The HDV evaporative emission rate was determined by assuming that HDVs travel an average of 10.9 trips per day and accumulate an average of 63.6 miles per day.

Chapter IV

HEAVY-DUTY, DIESEL-POWERED VEHICLES

A. *Introduction.* The discussion of heavy-duty, gasoline-powered vehicles in Chapter III is generally applicable to diesel-powered Heavy-duty vehicles.

As in Chapter III, the equation for calculating the composite emission factor is given by:

$$\mathrm{Enpsoq} = \mathrm{SUM}(\mathrm{Cipn}*\mathrm{Min}*\mathrm{Vips}*\mathrm{Pipnoq})$$

B. *Pollutant Emission Factors for HDD.* The first year emission rates and deterioration rates (per 10,000 miles) used to generate the tabled emission factors are given in Table IV-1.

The mean emission factors for diesel-powered heavy-duty vehicles are given in Tables IV-2 through IV-4.

Table IV-5a presents the average cumulative mileages for HDD vehicles by age, on July 1. The numbers in this table are derived from the mileages presented in Table IV-5, using the methodology presented in Appendix G.

C. Weighting Factors for HDD. The discussion of the weighting factor in Chapter III is applicable to diesel-powered HDVs as well as to gasoline-powered HDVs. Table IV-5 gives the fraction of annual travel by vehicle age for diesel-powered HDVs.

D. Speed Correction Factor for HDD. Table IV-6 gives the three coefficients needed to compute the speed correction factors for diesel-powered, heavy-duty vehicles. The correction factor can be applied between 5 and 55 mph.

E. Truck Characteristic Factor for HDD. As discussed in Chapter III, a correction factor has been developed to account for heavy-duty vehicle weight and power. This correction factor is applicable to diesel-powered HDVs from 19,000 to 55,000 pounds with engines ranging from 540 cubic inch displacement to 600 CID. This correction factor has been designed so as to adjust the tabled exhaust emission factors (assumed to be at half load) for empty trucks or for fully loaded trucks. Table IV-6 gives the coefficients needed to compute the truck characteristic correction factor.

When weight and power information is not available, the correction factor value should be set equal to one.

F. Idle Emission Factors for HDD. The idle emission rates for diesel-powered HDVs are given in Table IV-7. The idle deterioration rates are assumed to be zero for all model years.

Chapter V

MOTORCYCLES

A. Introduction. Motorcycles, which are not generally considered an important source of air pollution, have become more popular, and their numbers have been steadily increasing in the last few years. The majority of motorcycles are powered by either 2- or 4-stroke air-cooled engines; however, water-cooled motorcycles and Wankel-powered motorcycles have recently been introduced. Until recently, the predominant use of 4-stroke motorcycles was for on-highway use, while the 2-stroke motorcycles were predominantly for off-highway use. This difference in use was primarily a reflection of significant weight and power variations between available 2- and 4-stroke vehicles. As light-weight 4-strokes and more powerful 2-strokes become available, the relative number of motorcycles in each engine category may change. Currently, the nationwide population of motorcycles is approximately 49% 2-stroke and 51% 4-stroke. Although separate emission rates previously were given for 2-stroke and 4-stroke engines, the emission rates given here are composites of six different categories of motorcycles (small, medium, and large engines for 2-stroke and for 4-stroke).

B. Composite Exhaust Emission Equation. The composite exhaust emission factor for motorcycles is calculated using:

$$\text{Enpstwx} = \text{SUM}(\ \text{Cipn*Min*Bipstwx}\ )$$

where all lower case letters are subscripts and:

SUM( ) = summation over model year (i), from the calendar year for which emission factors are being calculated (i=n) to the calendar year 19 years previous (i=n-19).

Enpstwx = Composite emission factor in gm/mi for calendar year n, pollutant p, average speed s, ambient temperature t, fraction cold operation w, and fraction hot start operation x.

Cipn = The FTP (1975 Federal Test Procedure) mean emission factor for the ith model year motorcycles during calendar year n, and for pollutant p.

Min = The fraction of annual travel by the ith model year motorcycles during calendar year n.

Bipstwx = The temperature, speed, and hot/cold correction factor for the ith model year motorcycles for pollutant p, average speed s, ambient temperature t, fraction cold operation w, and fraction hot start operation x.

C. Pollutant emission factors for motorcycles. Zero mileage emission rates and deterioration rates are given in Table V-1. The mean emission factors for motorcycles are given in Tables V-2 through V-4. The emission factors are assumed to represent the average emissions for July of that calendar year. These factors are for the same FTP conditions (temperature, speed, etc.) as are applicable to light-duty vehicles (see discussion in Chapter I).

Table V-5a presents the average cumulative mileages for motorcycles by age, on July 1. The numbers in this table are derived from the mileages presented in Table V-5, using the methodology presented in Appendix G.

D. Travel Weighting Factor. The fraction of annual motorcycle travel by model year is shown in Table V-5.

E. Temperature-Speed-Hot/Cold Correction Factor. This new correction factor takes into account the ambient temperature, hot/cold weighting, and vehicle speed. The correction factor description in Chapter I for light-duty vehicles is equally applicable to motorcycles. Pre-1968 LDV factors are applicable to pre-1978 motorcycles, while 1973-74 LDV factors are applicable to 1978 and later model year motorcycles.

F. Idle Emission Factors. Motorcycle idle emission rates are given in Table V-7.

G. Evaporative Emission Factors. The motorcycle hydrocarbon evaporative emission rates were determined by assuming that motorcycles travel 3.2 trips/day and have an average mileage of 5.2 miles per urban trip. The number of trips per day and mileage per urban trip were taken from the 1974 Gallup Motorcycle Survey.

TABLE I-1

EXHAUST EMISSION RATES

LIGHT-DUTY VEHICLES

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

POLLUTANT	MODEL YEAR	A (GM/MILE) NEW VEHICLE EMISSION RATE	B (GM/MILE) DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1968	4.45	0.58
HC	1968-1974	2.43	0.53
HC	1975-1979	1.13	0.23
HC	1980+	0.13	0.23
CO	PRE-1968	68.30	3.06
CO	1968-1974	31.14	6.15
CO	1975-1979	18.60	2.80
CO	1980	3.00	2.30
CO	1981+	1.40	2.00
NOx	PRE-1968	3.58	0.00
NOx	1968-1972	4.43	0.00
NOx	1973-1974	2.98	0.00
NOx	1975-1976	2.42	0.08
NOx	1977-1980	1.50	0.16
NOx	1981+	0.29	0.22

The Exhaust Emission Factor is calculated from the linear equation $C = a + bY$, where C is the exhaust emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and $Y = M/10000$.

TABLE I-2

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY VEHICLES
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	14.2						*					
1952	14.0	14.2										
1953	13.7	14.0	14.2									
1954	13.4	13.7	14.0	14.2								
1955	13.1	13.4	13.7	14.0	14.2							
1956	12.8	13.1	13.4	13.7	14.0	14.2						
1957	12.5	12.8	13.1	13.4	13.7	14.0	14.2					
1958	12.1	12.5	12.8	13.1	13.4	13.7	14.0	14.2				
1959	11.7	12.1	12.5	12.8	13.1	13.4	13.7	14.0	14.2			
1960	11.3	11.7	12.1	12.5	12.8	13.1	13.4	13.7	14.0	14.2		
1961	10.9	11.3	11.7	12.1	12.5	12.8	13.1	13.4	13.7	14.0	14.2	
1962	10.4	10.9	11.3	11.7	12.1	12.5	12.8	13.1	13.4	13.7	14.0	14.2
1963	9.9	10.4	10.9	11.3	11.7	12.1	12.5	12.8	13.1	13.4	13.7	14.0
1964	9.3	9.9	10.4	10.9	11.3	11.7	12.1	12.5	12.8	13.1	13.4	13.7
1965	8.7	9.3	9.9	10.4	10.9	11.3	11.7	12.1	12.5	12.8	13.1	13.4
1966	8.0	8.7	9.3	9.9	10.4	10.9	11.3	11.7	12.1	12.5	12.8	13.1
1967	7.2	8.0	8.7	9.3	9.9	10.4	10.9	11.3	11.7	12.1	12.5	12.8
1968	4.3	5.0	5.7	6.3	6.9	7.4	7.9	8.3	8.7	9.1	9.4	9.8
1969	3.5	4.3	5.0	5.7	6.3	6.9	7.4	7.9	8.3	8.7	9.1	9.4
1970	2.7	3.5	4.3	5.0	5.7	6.3	6.9	7.4	7.9	8.3	8.7	9.1
1971		2.7	3.5	4.3	5.0	5.7	6.3	6.9	7.4	7.9	8.3	8.7
1972			2.7	3.5	4.3	5.0	5.7	6.3	6.9	7.4	7.9	8.3
1973				2.7	3.5	4.3	5.0	5.7	6.3	6.9	7.4	7.9
1974					2.7	3.5	4.3	5.0	5.7	6.3	6.9	7.4
1975						1.3	1.6	1.9	2.2	2.5	2.8	3.1
1976							1.3	1.6	1.9	2.2	2.5	2.8
1977								1.3	1.6	1.9	2.2	2.5
1978									1.3	1.6	1.9	2.2
1979										1.3	1.6	1.9
1980											0.3	0.6
1981												0.3
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE I-2 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY VEHICLES
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	14.2											
1964	14.0	14.2										
1965	13.7	14.0	14.2									
1966	13.4	13.7	14.0	14.2								
1967	13.1	13.4	13.7	14.0	14.2							
1968	10.1	10.4	10.6	10.9	11.1	11.4						
1969	9.8	10.1	10.4	10.6	10.9	11.1	11.4					
1970	9.4	9.8	10.1	10.4	10.6	10.9	11.1	11.4				
1971	9.1	9.4	9.8	10.1	10.4	10.6	10.9	11.1	11.4			
1972	8.7	9.1	9.4	9.8	10.1	10.4	10.6	10.9	11.1	11.4		
1973	8.3	8.7	9.1	9.4	9.8	10.1	10.4	10.6	10.9	11.1	11.4	
1974	7.9	8.3	8.7	9.1	9.4	9.8	10.1	10.4	10.6	10.9	11.1	11.4
1975	3.3	3.5	3.7	3.9	4.0	4.2	4.3	4.4	4.6	4.7	4.8	4.9
1976	3.1	3.3	3.5	3.7	3.9	4.0	4.2	4.3	4.4	4.6	4.7	4.8
1977	2.8	3.1	3.3	3.5	3.7	3.9	4.0	4.2	4.3	4.4	4.6	4.7
1978	2.5	2.8	3.1	3.3	3.5	3.7	3.9	4.0	4.2	4.3	4.4	4.6
1979	2.2	2.5	2.8	3.1	3.3	3.5	3.7	3.9	4.0	4.2	4.3	4.4
1980	0.9	1.2	1.5	1.8	2.1	2.3	2.5	2.7	2.9	3.0	3.2	3.3
1981	0.6	0.9	1.2	1.5	1.8	2.1	2.3	2.5	2.7	2.9	3.0	3.2
1982	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.3	2.5	2.7	2.9	3.0
1983		0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.3	2.5	2.7	2.9
1984			0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.3	2.5	2.7
1985				0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.3	2.5
1986					0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.3
1987						0.3	0.6	0.9	1.2	1.5	1.8	2.1
1988							0.3	0.6	0.9	1.2	1.5	1.8
1989								0.3	0.6	0.9	1.2	1.5
1990									0.3	0.6	0.9	1.2
1991										0.3	0.6	0.9
1992											0.3	0.6
1993												0.3

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE I-3

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY VEHICLES
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	119.9						*					
1952	118.5	119.9										
1953	117.1	118.5	119.9									
1954	115.6	117.1	118.5	119.9								
1955	114.0	115.6	117.1	118.5	119.9							
1956	112.4	114.0	115.6	117.1	118.5	119.9						
1957	110.6	112.4	114.0	115.6	117.1	118.5	119.9					
1958	108.7	110.6	112.4	114.0	115.6	117.1	118.5	119.9				
1959	106.7	108.7	110.6	112.4	114.0	115.6	117.1	118.5	119.9			
1960	104.7	106.7	108.7	110.6	112.4	114.0	115.6	117.1	118.5	119.9		
1961	102.4	104.7	106.7	108.7	110.6	112.4	114.0	115.6	117.1	118.5	119.9	
1962	99.9	102.4	104.7	106.7	108.7	110.6	112.4	114.0	115.6	117.1	118.5	119.9
1963	97.1	99.9	102.4	104.7	106.7	108.7	110.6	112.4	114.0	115.6	117.1	118.5
1964	94.0	97.1	99.9	102.4	104.7	106.7	108.7	110.6	112.4	114.0	115.6	117.1
1965	90.6	94.0	97.1	99.9	102.4	104.7	106.7	108.7	110.6	112.4	114.0	115.6
1966	87.0	90.6	94.0	97.1	99.9	102.4	104.7	106.7	108.7	110.6	112.4	114.0
1967	83.0	87.0	90.6	94.0	97.1	99.9	102.4	104.7	106.7	108.7	110.6	112.4
1968	52.3	60.8	68.7	76.0	82.8	89.0	94.7	99.8	104.3	108.4	112.4	116.2
1969	43.2	52.3	60.8	68.7	76.0	82.8	89.0	94.7	99.8	104.3	108.4	112.4
1970	34.8	43.2	52.3	60.8	68.7	76.0	82.8	89.0	94.7	99.8	104.3	108.4
1971		34.8	43.2	52.3	60.8	68.7	76.0	82.8	89.0	94.7	99.8	104.3
1972			34.8	43.2	52.3	60.8	68.7	76.0	82.8	89.0	94.7	99.8
1973				34.8	43.2	52.3	60.8	68.7	76.0	82.8	89.0	94.7
1974					34.8	43.2	52.3	60.8	68.7	76.0	82.8	89.0
1975						20.3	24.1	28.2	32.1	35.7	39.0	42.1
1976							20.3	24.1	28.2	32.1	35.7	39.0
1977								20.3	24.1	28.2	32.1	35.7
1978									20.3	24.1	28.2	32.1
1979										20.3	24.1	28.2
1980											4.4	7.5
1981												2.6
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE I-3 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY VEHICLES
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	119.9											
1964	118.5	119.9										
1965	117.1	118.5	119.9									
1966	115.6	117.1	118.5	119.9								
1967	114.0	115.6	117.1	118.5	119.9							
1968	119.7	123.1	126.2	129.2	132.1	134.8						
1969	116.2	119.7	123.1	126.2	129.2	132.1	134.8					
1970	112.4	116.2	119.7	123.1	126.2	129.2	132.1	134.8				
1971	108.4	112.4	116.2	119.7	123.1	126.2	129.2	132.1	134.8			
1972	104.3	108.4	112.4	116.2	119.7	123.1	126.2	129.2	132.1	134.8		
1973	99.8	104.3	108.4	112.4	116.2	119.7	123.1	126.2	129.2	132.1	134.8	
1974	94.7	99.8	104.3	108.4	112.4	116.2	119.7	123.1	126.2	129.2	132.1	134.8
1975	45.0	47.5	49.8	51.9	53.8	55.6	57.3	58.9	60.4	61.9	63.3	64.5
1976	42.1	45.0	47.5	49.8	51.9	53.8	55.6	57.3	58.9	60.4	61.9	63.3
1977	39.0	42.1	45.0	47.5	49.8	51.9	53.8	55.6	57.3	58.9	60.4	61.9
1978	35.7	39.0	42.1	45.0	47.5	49.8	51.9	53.8	55.6	57.3	58.9	60.4
1979	32.1	35.7	39.0	42.1	45.0	47.5	49.8	51.9	53.8	55.6	57.3	58.9
1980	10.9	14.1	17.0	19.8	22.3	24.6	26.8	28.7	30.4	31.9	33.4	34.8
1981	5.3	8.3	11.0	13.6	16.0	18.2	20.2	22.1	23.7	25.2	26.5	27.8
1982	2.6	5.3	8.3	11.0	13.6	16.0	18.2	20.2	22.1	23.7	25.2	26.5
1983		2.6	5.3	8.3	11.0	13.6	16.0	18.2	20.2	22.1	23.7	25.2
1984			2.6	5.3	8.3	11.0	13.6	16.0	18.2	20.2	22.1	23.7
1985				2.6	5.3	8.3	11.0	13.6	16.0	18.2	20.2	22.1
1986					2.6	5.3	8.3	11.0	13.6	16.0	18.2	20.2
1987						2.6	5.3	8.3	11.0	13.6	16.0	18.2
1988							2.6	5.3	8.3	11.0	13.6	16.0
1989								2.6	5.3	8.3	11.0	13.6
1990									2.6	5.3	8.3	11.0
1991										2.6	5.3	8.3
1992											2.6	5.3
1993												2.6

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE I-4

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY VEHICLES
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	3.6						*					
1952	3.6	3.6										
1953	3.6	3.6	3.6									
1954	3.6	3.6	3.6	3.6								
1955	3.6	3.6	3.6	3.6	3.6							
1956	3.6	3.6	3.6	3.6	3.6	3.6						
1957	3.6	3.6	3.6	3.6	3.6	3.6	3.6					
1958	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6				
1959	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6			
1960	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6		
1961	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	
1962	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1963	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1964	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1965	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1966	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1967	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1968	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
1969	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
1970	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
1971		4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
1972			4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
1973				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
1974					3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
1975						2.5	2.6	2.7	2.8	2.9	3.0	3.1
1976							2.5	2.6	2.7	2.8	2.9	3.0
1977								1.6	1.8	2.0	2.3	2.5
1978									1.6	1.8	2.0	2.3
1979										1.6	1.8	2.0
1980											1.6	1.8
1981												0.4
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE I-4 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY VEHICLES
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	3.6											
1964	3.6	3.6										
1965	3.6	3.6	3.6									
1966	3.6	3.6	3.6	3.6								
1967	3.6	3.6	3.6	3.6	3.6							
1968	4.4	4.4	4.4	4.4	4.4	4.4						
1969	4.4	4.4	4.4	4.4	4.4	4.4	4.4					
1970	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4				
1971	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4			
1972	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4		
1973	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
1974	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
1975	3.2	3.2	3.3	3.4	3.4	3.5	3.5	3.6	3.6	3.7	3.7	3.7
1976	3.1	3.2	3.2	3.3	3.4	3.4	3.5	3.5	3.6	3.6	3.7	3.7
1977	2.7	2.8	3.0	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0
1978	2.5	2.7	2.8	3.0	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
1979	2.3	2.5	2.7	2.8	3.0	3.2	3.3	3.4	3.5	3.6	3.7	3.8
1980	2.0	2.3	2.5	2.7	2.8	3.0	3.2	3.3	3.4	3.5	3.6	3.7
1981	0.7	1.0	1.3	1.6	1.9	2.1	2.4	2.6	2.7	2.9	3.1	3.2
1982	0.4	0.7	1.0	1.3	1.6	1.9	2.1	2.4	2.6	2.7	2.9	3.1
1983		0.4	0.7	1.0	1.3	1.6	1.9	2.1	2.4	2.6	2.7	2.9
1984			0.4	0.7	1.0	1.3	1.6	1.9	2.1	2.4	2.6	2.7
1985				0.4	0.7	1.0	1.3	1.6	1.9	2.1	2.4	2.6
1986					0.4	0.7	1.0	1.3	1.6	1.9	2.1	2.4
1987						0.4	0.7	1.0	1.3	1.6	1.9	2.1
1988							0.4	0.7	1.0	1.3	1.6	1.9
1989								0.4	0.7	1.0	1.3	1.6
1990									0.4	0.7	1.0	1.3
1991										0.4	0.7	1.0
1992											0.4	0.7
1993												0.4

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE I-5

TRAVEL WEIGHTING FACTOR CALCULATION

LIGHT-DUTY VEHICLES

Vehicle Age	(a) Fraction Total Registration	(b) Annual Mileage Accumulation Rate	(a)*(b)	((a)*(b)/SUM) Travel Fraction
1	0.075	15900	1192.5	0.106
2	0.107	15000	1605.0	0.142
3	0.107	14000	1498.0	0.133
4	0.106	13100	1388.6	0.123
5	0.100	12200	1220.0	0.108
6	0.092	11300	1039.6	0.092
7	0.085	10300	875.5	0.077
8	0.077	9400	723.8	0.064
9	0.066	8500	561.0	0.050
10	0.052	7600	395.2	0.035
11	0.039	6700	261.3	0.023
12	0.027	6600	178.2	0.016
13	0.018	6200	111.6	0.010
14	0.014	5900	82.6	0.007
15	0.009	5500	49.5	0.004
16	0.006	5100	30.6	0.003
17	0.005	5000	25.0	0.002
18	0.005	4700	23.5	0.002
19	0.005	4400	22.0	0.002
20	0.004	4400	17.6	0.002
		SUM:	11301.0	

TABLE I-5A

AVERAGE CUMULATIVE MILEAGE
BY VEHICLE AGE - July 1

LIGHT-DUTY VEHICLES

Age (Years)	Cumulative Mileage
1	5962
2	19622
3	34369
4	48147
5	61022
6	72997
7	84044
8	94122
9	103297
10	111571
11	118946
12	125646
13	132137
14	138265
15	144062
16	149462
17	154546
18	159465
19	164090
20	168499

The methodology for calculating average cumulative mileage is presented in Appendix G.

TABLE I-6

General Formula for Ripstwx

The general formula for the speed-temperature-hot/cold correction factor, Ripstwx, for LIGHT-DUTY VEHICLES is given by:

$$Ripstwx = \frac{\underline{(BAG1TERM + BAG3TERM + BAG2TERM)}}{DENOM}$$

where (using * for multiplication and exp for exponential function):

```
BAG1TERM =     w    *(exp(a-b*T) + c + d*A)*(v(2,s1)/v(2,26))
BAG3TERM =     x    *(               e + f*A)*(v(g,s3)/v(g,26))
BAG2TERM = (1-w-x)*(                h + j*A)*(v(g,s2)/v(g,16))
DENOM    = (d0 + d1*A)
```

w = fraction of total miles which are driven in cold start condition
x = fraction of total miles which are driven in hot start condition
T = ambient temperature (F)
A = vehicle age minus 1, in years
g = index for model-year/region groups; see Table I-6a
s1,s2,s3 = average speeds (miles/hour) for bags 1, 2, and 3
v(g,si) = bag-specific speed correction factor; see Appendix B

and where:
a,b,c,d,e,f,h,j,d0, and d1 are constant coefficients which are functions of model-year group and pollutant, as follows:

Pol	Eqn	a	b	c	d	e	f	h	j	d0	d1
HC	1	2.9310	.014779	.673	.569	4.75	.393	5.69	.471	5.67	.47
HC	2	2.9310	.014779	-2.41	.863	2.43	.555	2.61	.597	2.80	.64
HC	3	2.4339	.023591	.623	.301	1.11	.284	1.05	.270	1.38	.28
HC	4	1.9934	.022269	-.032	.445	.497	.357	.243	.175	.54	.28
CO	1	5.6548	.015965	-14.74	9.62	42.84	5.76	57.57	7.74	56.43	7.59
CO	2	5.6548	.015965	-33.89	9.77	25.26	4.71	35.90	6.70	36.40	6.79
CO	3	5.5460	.028945	11.29	4.24	15.85	2.34	21.17	3.13	23.70	3.14
CO	4	4.2391	.017522	-.20	6.99	4.12	2.20	3.96	2.12	6.98	3.14
NOx	1	-100.	0.0	1.14	0.0	1.25	0.0	0.81	0.0	1.0	0.0
NOx	2	-100.	0.0	1.16	0.0	1.26	0.0	0.80	0.0	1.0	0.0
NOx	3	-100.	0.0	3.26	.335	2.99	.184	1.89	.116	2.47	.18
NOx	4	-100.	0.0	3.05	.318	2.88	.180	2.01	.126	2.46	.18

Eqn	Used for Model Years:	
	For HC and CO	For NOx
1	Pre-1968	Pre-1968
2	1968-1974	1968-1974
3	1975-1979	1975-1976
4	Post-1979	Post-1976

TABLE I-6a

Specification of Speed Terms (Vg) Used in the General Formulas for Ripstwx

LIGHT-DUTY VEHICLES

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

Vehicle Group	Group Reference (g)
Low-Altitude Pre-1968	Group 2
Low-Altitude 1968	Group 4
Low-Altitude 1969	Group 5
Low-Altitude 1970	Group 6
Low-Altitude 1971	Group 7
Low-Altitude 1972	Group 14
Low-Altitude 1973-1974	Group 17
Low-Altitude 1975+	Group 18

TABLE I-7

IDLE EMISSION RATES

LIGHT-DUTY VEHICLES

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

POLLUTANT	MODEL YEAR	A (GM/MIN.) NEW VEHICLE EMISSION RATE	B (GM/MIN.) DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1968	2.01	0.18
HC	1968-1974	0.68	0.20
HC	1975-1979	0.27	0.07
HC	1980+	0.03	0.07
CO	PRE-1968	16.42	2.55
CO	1968-1974	12.73	2.92
CO	1975-1979	5.43	0.83
CO	1980	0.88	0.67
CO	1981+	0.41	0.59
NOX	PRE-1968	0.16	0.00
NOX	1968-1972	0.26	0.00
NOX	1973-1974	0.16	0.00
NOX	1975-1976	0.36	0.03
NOX	1977-1980	0.22	0.06
NOX	1981+	0.04	0.08

The Idle Emission Factor is calculated from the linear equation $C = a + bY$, where C is the idle emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and $Y = M/10000$.

TABLE I-8

Crankcase and Evaporative HC Emission Factors
(gm/mi)

LIGHT-DUTY VEHICLES

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

Model Year	Hydrocarbon Emissions(gm/mi)
Pre-1963	6.63
1963-1967	3.33
1968-1970	2.53
1971-1977	1.76
1978-1979	0.60
1980+	0.15

TABLE I-9

LDV Loading Correction Factor
(Additional 500 Pounds, All Model Years)

The Loading Correction Factor, L(p), is given by:

$$L(p) = u*(cf(p) - 1.0) + 1.0$$

where:

u = fraction of vehicles with additional load of 500 pounds

cf(p) = correction factor values selected from table below

L(p) = Loading Correction Factor

Pollutant(p)	cf(p)
HC	1.06
CO	1.20
NOx	1.03

TABLE I-10

LDV Trailer Towing Correction Factor

The Trailer Towing Correction Factor, L(p), is given by:

$$Uipw = u*(cf(p) - 1.0) + 1.0$$

where:

u = fraction of vehicles towing a trailer (1000 pounds)

$cf(p)$ = correction factor values selected from below

$Uipw$ = Correction Factor adjusted for usage level

A. cf(p) correction factor values for pre-1975 Model Years (additional 1000 pounds)

Pollutant	cf(p)
HC	1.32
CO	2.15
NOx	1.16

B. cf(p) correction factor values for 1975 and later Model Years (additional 1000 pounds)

$$cf(p) = \frac{w*a(p) + (1-w)*b(p)}{w + (1-w)*c(p)}$$

Pollutant	a(p)	b(p)	c(p)
HC	1.32	0.75	0.43
CO	2.15	1.55	0.39
NOx	1.16	1.28	0.92

and where w = fraction of total VMT in cold operation.

TABLE II-1

EXHAUST EMISSION RATES

LIGHT-DUTY TRUCKS: BOTH WEIGHT CATEGORIES

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

POLLUTANT	MODEL YEAR	A (GM/MILE) NEW VEHICLE EMISSION RATE	B (GM/MILE) DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1968	4.76	0.58
HC	1968-1969	3.25	0.54
HC	1970-1974	2.56	0.53
HC	1975-1978	1.92	0.46
HC	1979-1982	0.94	0.41
HC	1983+	0.31	0.23
CO	PRE-1968	70.38	3.06
CO	1968-1969	42.08	5.44
CO	1970-1974	31.48	6.15
CO	1975-1978	23.44	5.70
CO	1979-1982	14.50	5.34
CO	1983+	3.87	2.00
NOx	PRE-1968	4.16	0.00
NOx	1968-1969	4.90	0.00
NOx	1970-1972	4.59	0.00
NOx	1973-1974	3.56	0.00
NOx	1975-1978	3.62	0.00
NOx	1979-1984	1.73	0.11
NOx	1985+	0.41	0.22

The Exhaust Emission Factor is calculated from the linear equation $C = a + bY$, where C is the exhaust emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and $Y = M/10000$.

TABLE II-1A

EXHAUST EMISSION RATES

LIGHT-DUTY TRUCKS (0-6K GVW)

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

POLLUTANT	MODEL YEAR	A (GM/MILE) NEW VEHICLE EMISSION RATE	B (GM/MILE) DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1968	4.45	0.58
HC	1968-1974	2.43	0.53
HC	1975-1978	1.11	0.41
HC	1979-1982	0.94	0.41
HC	1983+	0.31	0.23
CO	PRE-1968	68.30	3.06
CO	1968-1974	31.14	6.15
CO	1975-1978	16.10	5.34
CO	1979-1982	14.50	5.34
CO	1983+	3.87	2.00
NOx	PRE-1968	3.58	0.00
NOx	1968-1972	4.43	0.00
NOx	1973-1974	2.98	0.00
NOx	1975-1978	2.45	0.00
NOx	1979-1984	1.73	0.11
NOx	1985+	0.41	0.22

The Exhaust Emission Factor is calculated from the linear equation $C = a + bY$, where C is the exhaust emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and $Y = M/10000$.

TABLE II-1B

EXHAUST EMISSION RATES

LIGHT-DUTY TRUCKS (6-8.5K GVW)

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

POLLUTANT	MODEL YEAR	A (GM/MILE) NEW VEHICLE EMISSION RATE	B (GM/MILE) DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1970	5.99	0.58
HC	1970-1978	2.90	0.53
HC	1979-1982	0.94	0.41
HC	1983+	0.31	0.23
CO	PRE-1970	78.70	3.06
CO	1970-1978	32.40	6.15
CO	1979-1982	14.50	5.34
CO	1983+	3.87	2.00
NOx	PRE-1970	6.49	0.00
NOx	1970-1978	5.04	0.00
NOx	1979-1984	1.73	0.11
NOx	1985+	0.41	0.22

The Exhaust Emission Factor is calculated from the linear equation C = a + bY, where C is the exhaust emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and Y = M/10000.

TABLE II-2

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY TRUCKS: BOTH WEIGHT CATEGORIES
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	14.5						*					
1952	14.2	14.5										
1953	14.0	14.2	14.5									
1954	13.7	14.0	14.2	14.5								
1955	13.4	13.7	14.0	14.2	14.5							
1956	13.1	13.4	13.7	14.0	14.2	14.5						
1957	12.7	13.1	13.4	13.7	14.0	14.2	14.5					
1958	12.4	12.7	13.1	13.4	13.7	14.0	14.2	14.5				
1959	12.0	12.4	12.7	13.1	13.4	13.7	14.0	14.2	14.5			
1960	11.6	12.0	12.4	12.7	13.1	13.4	13.7	14.0	14.2	14.5		
1961	11.2	11.6	12.0	12.4	12.7	13.1	13.4	13.7	14.0	14.2	14.5	
1962	10.7	11.2	11.6	12.0	12.4	12.7	13.1	13.4	13.7	14.0	14.2	14.5
1963	10.2	10.7	11.2	11.6	12.0	12.4	12.7	13.1	13.4	13.7	14.0	14.2
1964	9.6	10.2	10.7	11.2	11.6	12.0	12.4	12.7	13.1	13.4	13.7	14.0
1965	9.0	9.6	10.2	10.7	11.2	11.6	12.0	12.4	12.7	13.1	13.4	13.7
1966	8.3	9.0	9.6	10.2	10.7	11.2	11.6	12.0	12.4	12.7	13.1	13.4
1967	7.6	8.3	9.0	9.6	10.2	10.7	11.2	11.6	12.0	12.4	12.7	13.1
1968	5.1	5.9	6.6	7.2	7.8	8.3	8.8	9.2	9.6	10.0	10.4	10.7
1969	4.3	5.1	5.9	6.6	7.2	7.8	8.3	8.8	9.2	9.6	10.0	10.4
1970	2.9	3.6	4.4	5.1	5.8	6.4	7.0	7.5	8.0	8.4	8.8	9.2
1971		2.9	3.6	4.4	5.1	5.8	6.4	7.0	7.5	8.0	8.4	8.8
1972			2.9	3.6	4.4	5.1	5.8	6.4	7.0	7.5	8.0	8.4
1973				2.9	3.6	4.4	5.1	5.8	6.4	7.0	7.5	8.0
1974					2.9	3.6	4.4	5.1	5.8	6.4	7.0	7.5
1975						2.2	2.8	3.5	4.2	4.7	5.3	5.8
1976							2.2	2.8	3.5	4.2	4.7	5.3
1977								2.2	2.8	3.5	4.2	4.7
1978									2.2	2.8	3.5	4.2
1979										1.2	1.7	2.4
1980											1.2	1.7
1981												1.2
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-2 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY TRUCKS: BOTH WEIGHT CATEGORIES
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	14.5											
1964	14.2	14.5										
1965	14.0	14.2	14.5									
1966	13.7	14.0	14.2	14.5								
1967	13.4	13.7	14.0	14.2	14.5							
1968	11.0	11.3	11.6	11.8	12.1	12.3						
1969	10.7	11.0	11.3	11.6	11.8	12.1	12.3					
1970	9.5	9.8	10.1	10.4	10.7	11.0	11.2	11.4				
1971	9.2	9.5	9.8	10.1	10.4	10.7	11.0	11.2	11.4			
1972	8.8	9.2	9.5	9.8	10.1	10.4	10.7	11.0	11.2	11.4		
1973	8.4	8.8	9.2	9.5	9.8	10.1	10.4	10.7	11.0	11.2	11.4	
1974	8.0	8.4	8.8	9.2	9.5	9.8	10.1	10.4	10.7	11.0	11.2	11.4
1975	6.2	6.6	7.0	7.3	7.7	8.0	8.2	8.5	8.8	9.0	9.2	9.4
1976	5.8	6.2	6.6	7.0	7.3	7.7	8.0	8.2	8.5	8.8	9.0	9.2
1977	5.3	5.8	6.2	6.6	7.0	7.3	7.7	8.0	8.2	8.5	8.8	9.0
1978	4.7	5.3	5.8	6.2	6.6	7.0	7.3	7.7	8.0	8.2	8.5	8.8
1979	2.9	3.4	3.9	4.3	4.7	5.1	5.4	5.7	6.0	6.3	6.5	6.8
1980	2.4	2.9	3.4	3.9	4.3	4.7	5.1	5.4	5.7	6.0	6.3	6.5
1981	1.7	2.4	2.9	3.4	3.9	4.3	4.7	5.1	5.4	5.7	6.0	6.3
1982	1.2	1.7	2.4	2.9	3.4	3.9	4.3	4.7	5.1	5.4	5.7	6.0
1983		0.4	0.8	1.1	1.4	1.7	2.0	2.2	2.4	2.6	2.8	3.0
1984			0.4	0.8	1.1	1.4	1.7	2.0	2.2	2.4	2.6	2.8
1985				0.4	0.8	1.1	1.4	1.7	2.0	2.2	2.4	2.6
1986					0.4	0.8	1.1	1.4	1.7	2.0	2.2	2.4
1987						0.4	0.8	1.1	1.4	1.7	2.0	2.2
1988							0.4	0.8	1.1	1.4	1.7	2.0
1989								0.4	0.8	1.1	1.4	1.7
1990									0.4	0.8	1.1	1.4
1991										0.4	0.8	1.1
1992											0.4	0.8
1993												0.4

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-3

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY TRUCKS: BOTH WEIGHT CATEGORIES
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	121.7						*					
1952	120.4	121.7										
1953	119.0	120.4	121.7									
1954	117.5	119.0	120.4	121.7								
1955	115.9	117.5	119.0	120.4	121.7							
1956	114.2	115.9	117.5	119.0	120.4	121.7						
1957	112.5	114.2	115.9	117.5	119.0	120.4	121.7					
1958	110.6	112.5	114.2	115.9	117.5	119.0	120.4	121.7				
1959	108.6	110.6	112.5	114.2	115.9	117.5	119.0	120.4	121.7			
1960	106.5	108.6	110.6	112.5	114.2	115.9	117.5	119.0	120.4	121.7		
1961	104.3	106.5	108.6	110.6	112.5	114.2	115.9	117.5	119.0	120.4	121.7	
1962	101.8	104.3	106.5	108.6	110.6	112.5	114.2	115.9	117.5	119.0	120.4	121.7
1963	99.0	101.8	104.3	106.5	108.6	110.6	112.5	114.2	115.9	117.5	119.0	120.4
1964	96.0	99.0	101.8	104.3	106.5	108.6	110.6	112.5	114.2	115.9	117.5	119.0
1965	92.7	96.0	99.0	101.8	104.3	106.5	108.6	110.6	112.5	114.2	115.9	117.5
1966	89.0	92.7	96.0	99.0	101.8	104.3	106.5	108.6	110.6	112.5	114.2	115.9
1967	85.1	89.0	92.7	96.0	99.0	101.8	104.3	106.5	108.6	110.6	112.5	114.2
1968	60.8	68.3	75.3	81.7	87.6	93.1	98.0	102.5	106.5	110.2	113.7	117.0
1969	52.8	60.8	68.3	75.3	81.7	87.6	93.1	98.0	102.5	106.5	110.2	113.7
1970	35.1	43.5	52.7	61.2	69.0	76.2	82.8	88.9	94.4	99.4	104.0	108.1
1971		35.1	43.5	52.7	61.2	69.0	76.2	82.8	88.9	94.4	99.4	104.0
1972			35.1	43.5	52.7	61.2	69.0	76.2	82.8	88.9	94.4	99.4
1973				35.1	43.6	52.7	61.2	69.0	76.2	82.8	88.9	94.4
1974					35.1	43.6	52.7	61.2	69.0	76.2	82.8	88.9
1975						26.8	34.6	43.2	51.0	58.2	64.8	70.8
1976							26.8	34.6	43.2	51.0	58.2	64.8
1977								26.8	34.6	43.2	51.0	58.2
1978									26.8	34.6	43.2	51.0
1979										17.7	25.0	33.0
1980											17.7	25.0
1981												17.7
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-3 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY TRUCKS: BOTH WEIGHT CATEGORIES
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	121.7											
1964	120.4	121.7										
1965	119.0	120.4	121.7									
1966	117.5	119.0	120.4	121.7								
1967	115.9	117.5	119.0	120.4	121.7							
1968	120.2	123.1	125.9	128.6	131.1	133.5						
1969	117.0	120.2	123.1	125.9	128.6	131.1	133.5					
1970	112.1	115.9	119.5	122.8	126.0	129.0	131.8	134.5				
1971	108.1	112.1	115.9	119.5	122.8	126.0	129.0	131.8	134.5			
1972	104.0	108.1	112.1	115.9	119.5	122.8	126.0	129.0	131.8	134.5		
1973	99.4	103.9	108.1	112.1	115.9	119.5	122.8	125.9	129.0	131.8	134.5	
1974	94.4	99.4	103.9	108.1	112.1	115.9	119.5	122.8	125.9	129.0	131.8	134.5
1975	76.3	81.3	85.9	90.2	94.1	97.8	101.3	104.6	107.7	110.6	113.4	116.1
1976	70.8	76.3	81.3	85.9	90.2	94.1	97.8	101.3	104.6	107.7	110.6	113.4
1977	64.8	70.8	76.3	81.3	85.9	90.2	94.1	97.8	101.3	104.6	107.7	110.6
1978	58.2	64.8	70.8	76.3	81.3	85.9	90.2	94.1	97.8	101.3	104.6	107.7
1979	40.3	47.1	53.2	58.9	64.0	68.8	73.1	77.0	80.7	84.2	87.5	90.6
1980	33.0	40.3	47.1	53.2	58.9	64.0	68.8	73.1	77.0	80.7	84.2	87.5
1981	25.0	33.0	40.3	47.1	53.2	58.9	64.0	68.8	73.1	77.0	80.7	84.2
1982	17.7	25.0	33.0	40.3	47.1	53.2	58.9	64.0	68.8	73.1	77.0	80.7
1983		5.1	7.8	10.8	13.5	16.1	18.4	20.5	22.4	24.2	25.8	27.3
1984			5.1	7.8	10.8	13.5	16.1	18.4	20.5	22.4	24.2	25.8
1985				5.1	7.8	10.8	13.5	16.1	18.4	20.5	22.4	24.2
1986					5.1	7.8	10.8	13.5	16.1	18.4	20.5	22.4
1987						5.1	7.8	10.8	13.5	16.1	18.4	20.5
1988							5.1	7.8	10.8	13.5	16.1	18.4
1989								5.1	7.8	10.8	13.5	16.1
1990									5.1	7.8	10.8	13.5
1991										5.1	7.8	10.8
1992											5.1	7.8
1993												5.1

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-4

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY TRUCKS: BOTH WEIGHT CATEGORIES
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	4.2						*					
1952	4.2	4.2										
1953	4.2	4.2	4.2									
1954	4.2	4.2	4.2	4.2								
1955	4.2	4.2	4.2	4.2	4.2							
1956	4.2	4.2	4.2	4.2	4.2	4.2						
1957	4.2	4.2	4.2	4.2	4.2	4.2	4.2					
1958	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2				
1959	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2			
1960	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2		
1961	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	
1962	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
1963	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
1964	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
1965	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
1966	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
1967	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
1968	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
1969	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
1970	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
1971		4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
1972			4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
1973				3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1974					3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1975						3.6	3.6	3.6	3.6	3.6	3.6	3.6
1976							3.6	3.6	3.6	3.6	3.6	3.6
1977								3.6	3.6	3.6	3.6	3.6
1978									3.6	3.6	3.6	3.6
1979										1.8	1.9	2.1
1980											1.8	1.9
1981												1.8
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-4 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY TRUCKS: BOTH WEIGHT CATEGORIES
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	4.2											
1964	4.2	4.2										
1965	4.2	4.2	4.2									
1966	4.2	4.2	4.2	4.2								
1967	4.2	4.2	4.2	4.2	4.2							
1968	4.9	4.9	4.9	4.9	4.9	4.9						
1969	4.9	4.9	4.9	4.9	4.9	4.9	4.9					
1970	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6				
1971	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6			
1972	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6		
1973	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	
1974	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1975	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1976	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1977	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1978	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1979	2.3	2.4	2.5	2.6	2.8	2.8	2.9	3.0	3.1	3.2	3.2	3.3
1980	2.1	2.3	2.4	2.5	2.6	2.8	2.8	2.9	3.0	3.1	3.2	3.2
1981	1.9	2.1	2.3	2.4	2.5	2.6	2.8	2.8	2.9	3.0	3.1	3.2
1982	1.8	1.9	2.1	2.3	2.4	2.5	2.6	2.8	2.8	2.9	3.0	3.1
1983		1.8	1.9	2.1	2.3	2.4	2.5	2.6	2.8	2.8	2.9	3.0
1984			1.8	1.9	2.1	2.3	2.4	2.5	2.6	2.8	2.8	2.9
1985				0.5	0.8	1.2	1.5	1.8	2.0	2.2	2.5	2.6
1986					0.5	0.8	1.2	1.5	1.8	2.0	2.2	2.5
1987						0.5	0.8	1.2	1.5	1.8	2.0	2.2
1988							0.5	0.8	1.2	1.5	1.8	2.0
1989								0.5	0.8	1.2	1.5	1.8
1990									0.5	0.8	1.2	1.5
1991										0.5	0.8	1.2
1992											0.5	0.8
1993												0.5

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-2A

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY GAS TRUCKS < 6000 LBS.
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL YEAR	CALENDAR YEAR - July 1 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	14.2						*					
1952	14.0	14.2										
1953	13.7	14.0	14.2									
1954	13.4	13.7	14.0	14.2								
1955	13.1	13.4	13.7	14.0	14.2							
1956	12.8	13.1	13.4	13.7	14.0	14.2						
1957	12.5	12.8	13.1	13.4	13.7	14.0	14.2					
1958	12.1	12.5	12.8	13.1	13.4	13.7	14.0	14.2				
1959	11.7	12.1	12.5	12.8	13.1	13.4	13.7	14.0	14.2			
1960	11.3	11.7	12.1	12.5	12.8	13.1	13.4	13.7	14.0	14.2		
1961	10.9	11.3	11.7	12.1	12.5	12.8	13.1	13.4	13.7	14.0	14.2	
1962	10.4	10.9	11.3	11.7	12.1	12.5	12.8	13.1	13.4	13.7	14.0	14.2
1963	9.9	10.4	10.9	11.3	11.7	12.1	12.5	12.8	13.1	13.4	13.7	14.0
1964	9.3	9.9	10.4	10.9	11.3	11.7	12.1	12.5	12.8	13.1	13.4	13.7
1965	8.7	9.3	9.9	10.4	10.9	11.3	11.7	12.1	12.5	12.8	13.1	13.4
1966	8.0	8.7	9.3	9.9	10.4	10.9	11.3	11.7	12.1	12.5	12.8	13.1
1967	7.2	8.0	8.7	9.3	9.9	10.4	10.9	11.3	11.7	12.1	12.5	12.8
1968	4.3	5.0	5.7	6.3	6.9	7.4	7.9	8.3	8.7	9.1	9.4	9.8
1969	3.5	4.3	5.0	5.7	6.3	6.9	7.4	7.9	8.3	8.7	9.1	9.4
1970	2.7	3.5	4.3	5.0	5.7	6.3	6.9	7.4	7.9	8.3	8.7	9.1
1971		2.7	3.5	4.3	5.0	5.7	6.3	6.9	7.4	7.9	8.3	8.7
1972			2.7	3.5	4.3	5.0	5.7	6.3	6.9	7.4	7.9	8.3
1973				2.7	3.5	4.3	5.0	5.7	6.3	6.9	7.4	7.9
1974					2.7	3.5	4.3	5.0	5.7	6.3	6.9	7.4
1975						1.4	1.9	2.5	3.1	3.6	4.1	4.6
1976							1.4	1.9	2.5	3.1	3.6	4.1
1977								1.4	1.9	2.5	3.1	3.6
1978									1.4	1.9	2.5	3.1
1979										1.2	1.7	2.3
1980											1.2	1.7
1981												1.2
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-2A (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY GAS TRUCKS < 6000 LBS.
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	14.2											
1964	14.0	14.2										
1965	13.7	14.0	14.2									
1966	13.4	13.7	14.0	14.2								
1967	13.1	13.4	13.7	14.0	14.2							
1968	10.1	10.4	10.6	10.9	11.1	11.4						
1969	9.8	10.1	10.4	10.6	10.9	11.1	11.4					
1970	9.4	9.8	10.1	10.4	10.6	10.9	11.1	11.4				
1971	9.1	9.4	9.8	10.1	10.4	10.6	10.9	11.1	11.4			
1972	8.7	9.1	9.4	9.8	10.1	10.4	10.6	10.9	11.1	11.4		
1973	8.3	8.7	9.1	9.4	9.8	10.1	10.4	10.6	10.9	11.1	11.4	
1974	7.9	8.3	8.7	9.1	9.4	9.8	10.1	10.4	10.6	10.9	11.1	11.4
1975	5.0	5.3	5.7	6.0	6.3	6.5	6.8	7.0	7.2	7.4	7.6	7.8
1976	4.6	5.0	5.3	5.7	6.0	6.3	6.5	6.8	7.0	7.2	7.4	7.6
1977	4.1	4.6	5.0	5.3	5.7	6.0	6.3	6.5	6.8	7.0	7.2	7.4
1978	3.6	4.1	4.6	5.0	5.3	5.7	6.0	6.3	6.5	6.8	7.0	7.2
1979	2.9	3.4	3.9	4.4	4.8	5.2	5.5	5.8	6.1	6.4	6.6	6.8
1980	2.3	2.9	3.4	3.9	4.4	4.8	5.2	5.5	5.8	6.1	6.4	6.6
1981	1.7	2.3	2.9	3.4	3.9	4.4	4.8	5.2	5.5	5.8	6.1	6.4
1982	1.2	1.7	2.3	2.9	3.4	3.9	4.4	4.8	5.2	5.5	5.8	6.1
1983		0.4	0.8	1.1	1.4	1.7	2.0	2.2	2.5	2.7	2.9	3.0
1984			0.4	0.8	1.1	1.4	1.7	2.0	2.2	2.5	2.7	2.9
1985				0.4	0.8	1.1	1.4	1.7	2.0	2.2	2.5	2.7
1986					0.4	0.8	1.1	1.4	1.7	2.0	2.2	2.5
1987						0.4	0.8	1.1	1.4	1.7	2.0	2.2
1988							0.4	0.8	1.1	1.4	1.7	2.0
1989								0.4	0.8	1.1	1.4	1.7
1990									0.4	0.8	1.1	1.4
1991										0.4	0.8	1.1
1992											0.4	0.8
1993												0.4

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-3A

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY GAS TRUCKS < 6000 LBS.
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	119.9						*					
1952	118.5	119.9										
1953	117.1	118.5	119.9									
1954	115.6	117.1	118.5	119.9								
1955	114.0	115.6	117.1	118.5	119.9							
1956	112.4	114.0	115.6	117.1	118.5	119.9						
1957	110.6	112.4	114.0	115.6	117.1	118.5	119.9					
1958	108.7	110.6	112.4	114.0	115.6	117.1	118.5	119.9				
1959	106.7	108.7	110.6	112.4	114.0	115.6	117.1	118.5	119.9			
1960	104.7	106.7	108.7	110.6	112.4	114.0	115.6	117.1	118.5	119.9		
1961	102.4	104.7	106.7	108.7	110.6	112.4	114.0	115.6	117.1	118.5	119.9	
1962	99.9	102.4	104.7	106.7	108.7	110.6	112.4	114.0	115.6	117.1	118.5	119.9
1963	97.1	99.9	102.4	104.7	106.7	108.7	110.6	112.4	114.0	115.6	117.1	118.5
1964	94.0	97.1	99.9	102.4	104.7	106.7	108.7	110.6	112.4	114.0	115.6	117.1
1965	90.6	94.0	97.1	99.9	102.4	104.7	106.7	108.7	110.6	112.4	114.0	115.6
1966	87.0	90.6	94.0	97.1	99.9	102.4	104.7	106.7	108.7	110.6	112.4	114.0
1967	83.0	87.0	90.6	94.0	97.1	99.9	102.4	104.7	106.7	108.7	110.6	112.4
1968	52.3	60.8	68.7	76.0	82.8	89.0	94.7	99.8	104.3	108.4	112.4	116.2
1969	43.2	52.3	60.8	68.7	76.0	82.8	89.0	94.7	99.8	104.3	108.4	112.4
1970	34.8	43.2	52.3	60.8	68.7	76.0	82.8	89.0	94.7	99.8	104.3	108.4
1971		34.8	43.2	52.3	60.8	68.7	76.0	82.8	89.0	94.7	99.8	104.3
1972			34.8	43.2	52.3	60.8	68.7	76.0	82.8	89.0	94.7	99.8
1973				34.8	43.2	52.3	60.8	68.7	76.0	82.8	89.0	94.7
1974					34.8	43.2	52.3	60.8	68.7	76.0	82.8	89.0
1975						19.3	26.6	34.5	41.8	48.7	55.1	61.0
1976							19.3	26.6	34.5	41.8	48.7	55.1
1977								19.3	26.6	34.5	41.8	48.7
1978									19.3	26.6	34.5	41.8
1979										17.7	25.0	32.9
1980											17.7	25.0
1981												17.7
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-3A (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY GAS TRUCKS < 6000 LBS.
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	119.9											
1964	118.5	119.9										
1965	117.1	118.5	119.9									
1966	115.6	117.1	118.5	119.9								
1967	114.0	115.6	117.1	118.5	119.9							
1968	119.7	123.1	126.2	129.2	132.1	134.8						
1969	116.2	119.7	123.1	126.2	129.2	132.1	134.8					
1970	112.4	116.2	119.7	123.1	126.2	129.2	132.1	134.8				
1971	108.4	112.4	116.2	119.7	123.1	126.2	129.2	132.1	134.8			
1972	104.3	108.4	112.4	116.2	119.7	123.1	126.2	129.2	132.1	134.8		
1973	99.8	104.3	108.4	112.4	116.2	119.7	123.1	126.2	129.2	132.1	134.8	
1974	94.7	99.8	104.3	108.4	112.4	116.2	119.7	123.1	126.2	129.2	132.1	134.8
1975	66.4	71.3	75.7	79.6	83.2	86.7	89.9	93.0	95.9	98.6	101.3	103.7
1976	61.0	66.4	71.3	75.7	79.6	83.2	86.7	89.9	93.0	95.9	98.6	101.3
1977	55.1	61.0	66.4	71.3	75.7	79.6	83.2	86.7	89.9	93.0	95.9	98.6
1978	48.7	55.1	61.0	66.4	71.3	75.7	79.6	83.2	86.7	89.9	93.0	95.9
1979	40.2	47.1	53.5	59.4	64.8	69.7	74.1	78.0	81.6	85.1	88.3	91.4
1980	32.9	40.2	47.1	53.5	59.4	64.8	69.7	74.1	78.0	81.6	85.1	88.3
1981	25.0	32.9	40.2	47.1	53.5	59.4	64.8	69.7	74.1	78.0	81.6	85.1
1982	17.7	25.0	32.9	40.2	47.1	53.5	59.4	64.8	69.7	74.1	78.0	81.6
1983		5.1	7.8	10.7	13.5	16.1	18.5	20.7	22.7	24.5	26.2	27.7
1984			5.1	7.8	10.7	13.5	16.1	18.5	20.7	22.7	24.5	26.2
1985				5.1	7.8	10.7	13.5	16.1	18.5	20.7	22.7	24.5
1986					5.1	7.8	10.7	13.5	16.1	18.5	20.7	22.7
1987						5.1	7.8	10.7	13.5	16.1	18.5	20.7
1988							5.1	7.8	10.7	13.5	16.1	18.5
1989								5.1	7.8	10.7	13.5	16.1
1990									5.1	7.8	10.7	13.5
1991										5.1	7.8	10.7
1992											5.1	7.8
1993												5.1

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-4A

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY GAS TRUCKS < 6000 LBS.
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	3.6					*						
1952	3.6	3.6										
1953	3.6	3.6	3.6									
1954	3.6	3.6	3.6	3.6								
1955	3.6	3.6	3.6	3.6	3.6							
1956	3.6	3.6	3.6	3.6	3.6	3.6						
1957	3.6	3.6	3.6	3.6	3.6	3.6	3.6					
1958	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6				
1959	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6			
1960	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6		
1961	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	
1962	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1963	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1964	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1965	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1966	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1967	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1968	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
1969	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
1970	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
1971		4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
1972			4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
1973				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
1974					3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
1975						2.4	2.4	2.4	2.4	2.4	2.4	2.4
1976							2.4	2.4	2.4	2.4	2.4	2.4
1977								2.4	2.4	2.4	2.4	2.4
1978									2.4	2.4	2.4	2.4
1979										1.8	1.9	2.1
1980											1.8	1.9
1981												1.8
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-4A (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY GAS TRUCKS < 6000 LBS.
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	3.6											
1964	3.6	3.6										
1965	3.6	3.6	3.6									
1966	3.6	3.6	3.6	3.6								
1967	3.6	3.6	3.6	3.6	3.6							
1968	4.4	4.4	4.4	4.4	4.4	4.4						
1969	4.4	4.4	4.4	4.4	4.4	4.4	4.4					
1970	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4				
1971	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4			
1972	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4		
1973	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
1974	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
1975	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
1976	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
1977	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
1978	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
1979	2.3	2.4	2.5	2.7	2.8	2.9	3.0	3.0	3.1	3.2	3.3	3.3
1980	2.1	2.3	2.4	2.5	2.7	2.8	2.9	3.0	3.0	3.1	3.2	3.3
1981	1.9	2.1	2.3	2.4	2.5	2.7	2.8	2.9	3.0	3.0	3.1	3.2
1982	1.8	1.9	2.1	2.3	2.4	2.5	2.7	2.8	2.9	3.0	3.0	3.1
1983		1.8	1.9	2.1	2.3	2.4	2.5	2.7	2.8	2.9	3.0	3.0
1984			1.8	1.9	2.1	2.3	2.4	2.5	2.7	2.8	2.9	3.0
1985				0.5	0.8	1.2	1.5	1.8	2.0	2.3	2.5	2.7
1986					0.5	0.8	1.2	1.5	1.8	2.0	2.3	2.5
1987						0.5	0.8	1.2	1.5	1.8	2.0	2.3
1988							0.5	0.8	1.2	1.5	1.8	2.0
1989								0.5	0.8	1.2	1.5	1.8
1990									0.5	0.8	1.2	1.5
1991										0.5	0.8	1.2
1992											0.5	0.8
1993												0.5

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-2B

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY GAS TRUCKS 6001-8500 LBS.
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL YEAR	CALENDAR YEAR - July 1 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	15.6					*						
1952	15.3	15.6										
1953	15.0	15.3	15.6									
1954	14.8	15.0	15.3	15.6								
1955	14.5	14.8	15.0	15.3	15.6							
1956	14.1	14.5	14.8	15.0	15.3	15.6						
1957	13.8	14.1	14.5	14.8	15.0	15.3	15.6					
1958	13.4	13.8	14.1	14.5	14.8	15.0	15.3	15.6				
1959	13.1	13.4	13.8	14.1	14.5	14.8	15.0	15.3	15.6			
1960	12.7	13.1	13.4	13.8	14.1	14.5	14.8	15.0	15.3	15.6		
1961	12.2	12.7	13.1	13.4	13.8	14.1	14.5	14.8	15.0	15.3	15.6	
1962	11.8	12.2	12.7	13.1	13.4	13.8	14.1	14.5	14.8	15.0	15.3	15.6
1963	11.3	11.8	12.2	12.7	13.1	13.4	13.8	14.1	14.5	14.8	15.0	15.3
1964	10.7	11.3	11.8	12.2	12.7	13.1	13.4	13.8	14.1	14.5	14.8	15.0
1965	10.2	10.7	11.3	11.8	12.2	12.7	13.1	13.4	13.8	14.1	14.5	14.8
1966	9.5	10.2	10.7	11.3	11.8	12.2	12.7	13.1	13.4	13.8	14.1	14.5
1967	8.8	9.5	10.2	10.7	11.3	11.8	12.2	12.7	13.1	13.4	13.8	14.1
1968	8.0	8.8	9.5	10.2	10.7	11.3	11.8	12.2	12.7	13.1	13.4	13.8
1969	7.1	8.0	8.8	9.5	10.2	10.7	11.3	11.8	12.2	12.7	13.1	13.4
1970	3.2	3.9	4.7	5.5	6.1	6.7	7.2	7.7	8.2	8.6	9.0	9.4
1971		3.2	3.9	4.7	5.5	6.1	6.7	7.2	7.7	8.2	8.6	9.0
1972			3.2	3.9	4.7	5.5	6.1	6.7	7.2	7.7	8.2	8.6
1973				3.2	3.9	4.7	5.5	6.1	6.7	7.2	7.7	8.2
1974					3.2	3.9	4.7	5.5	6.1	6.7	7.2	7.7
1975						3.2	3.9	4.7	5.5	6.1	6.7	7.2
1976							3.2	3.9	4.7	5.5	6.1	6.7
1977								3.2	3.9	4.7	5.5	6.1
1978									3.2	3.9	4.7	5.5
1979										1.2	1.7	2.4
1980											1.2	1.7
1981												1.2
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-2B (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY GAS TRUCKS 6001-8500 LBS.
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL YEAR	CALENDAR YEAR - July 1 1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	15.6											
1964	15.3	15.6										
1965	15.0	15.3	15.6									
1966	14.8	15.0	15.3	15.6								
1967	14.5	14.8	15.0	15.3	15.6							
1968	14.1	14.5	14.8	15.0	15.3	15.6						
1969	13.8	14.1	14.5	14.8	15.0	15.3	15.6					
1970	9.7	10.0	10.3	10.6	10.9	11.2	11.4	11.6				
1971	9.4	9.7	10.0	10.3	10.6	10.9	11.2	11.4	11.6			
1972	9.0	9.4	9.7	10.0	10.3	10.6	10.9	11.2	11.4	11.6		
1973	8.6	9.0	9.4	9.7	10.0	10.3	10.6	10.9	11.2	11.4	11.6	
1974	8.2	8.6	9.0	9.4	9.7	10.0	10.3	10.6	10.9	11.2	11.4	11.6
1975	7.7	8.2	8.6	9.0	9.4	9.7	10.0	10.3	10.6	10.9	11.2	11.4
1976	7.2	7.7	8.2	8.6	9.0	9.4	9.7	10.0	10.3	10.6	10.9	11.2
1977	6.7	7.2	7.7	8.2	8.6	9.0	9.4	9.7	10.0	10.3	10.6	10.9
1978	6.1	6.7	7.2	7.7	8.2	8.6	9.0	9.4	9.7	10.0	10.3	10.6
1979	2.9	3.4	3.9	4.3	4.7	5.0	5.3	5.6	5.9	6.2	6.5	6.7
1980	2.4	2.9	3.4	3.9	4.3	4.7	5.0	5.3	5.6	5.9	6.2	6.5
1981	1.7	2.4	2.9	3.4	3.9	4.3	4.7	5.0	5.3	5.6	5.9	6.2
1982	1.2	1.7	2.4	2.9	3.4	3.9	4.3	4.7	5.0	5.3	5.6	5.9
1983		0.4	0.8	1.1	1.4	1.7	2.0	2.2	2.4	2.6	2.8	3.0
1984			0.4	0.8	1.1	1.4	1.7	2.0	2.2	2.4	2.6	2.8
1985				0.4	0.8	1.1	1.4	1.7	2.0	2.2	2.4	2.6
1986					0.4	0.8	1.1	1.4	1.7	2.0	2.2	2.4
1987						0.4	0.8	1.1	1.4	1.7	2.0	2.2
1988							0.4	0.8	1.1	1.4	1.7	2.0
1989								0.4	0.8	1.1	1.4	1.7
1990									0.4	0.8	1.1	1.4
1991										0.4	0.8	1.1
1992											0.4	0.8
1993												0.4

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-3B

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY GAS TRUCKS 6001-8500 LBS.
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	129.2						*					
1952	127.8	129.2										
1953	126.4	127.8	129.2									
1954	124.9	126.4	127.8	129.2								
1955	123.3	124.9	126.4	127.8	129.2							
1956	121.7	123.3	124.9	126.4	127.8	129.2						
1957	119.9	121.7	123.3	124.9	126.4	127.8	129.2					
1958	118.0	119.9	121.7	123.3	124.9	126.4	127.8	129.2				
1959	116.0	118.0	119.9	121.7	123.3	124.9	126.4	127.8	129.2			
1960	113.8	116.0	118.0	119.9	121.7	123.3	124.9	126.4	127.8	129.2		
1961	111.6	113.8	116.0	118.0	119.9	121.7	123.3	124.9	126.4	127.8	129.2	
1962	109.2	111.6	113.8	116.0	118.0	119.9	121.7	123.3	124.9	126.4	127.8	129.2
1963	106.6	109.2	111.6	113.8	116.0	118.0	119.9	121.7	123.3	124.9	126.4	127.8
1964	103.8	106.6	109.2	111.6	113.8	116.0	118.0	119.9	121.7	123.3	124.9	126.4
1965	100.7	103.8	106.6	109.2	111.6	113.8	116.0	118.0	119.9	121.7	123.3	124.9
1966	97.3	100.7	103.8	106.6	109.2	111.6	113.8	116.0	118.0	119.9	121.7	123.3
1967	93.6	97.3	100.7	103.8	106.6	109.2	111.6	113.8	116.0	118.0	119.9	121.7
1968	89.4	93.6	97.3	100.7	103.8	106.6	109.2	111.6	113.8	116.0	118.0	119.9
1969	84.7	89.4	93.6	97.3	100.7	103.8	106.6	109.2	111.6	113.8	116.0	118.0
1970	36.0	44.5	53.8	62.3	69.8	76.6	82.8	88.4	93.6	98.5	103.0	107.3
1971		36.0	44.5	53.8	62.3	69.8	76.6	82.8	88.4	93.6	98.5	103.0
1972			36.0	44.5	53.8	62.3	69.8	76.6	82.8	88.4	93.6	98.5
1973				36.0	44.5	53.8	62.3	69.8	76.6	82.8	88.4	93.6
1974					36.0	44.5	53.8	62.3	69.8	76.6	82.8	88.4
1975						36.0	44.5	53.8	62.3	69.8	76.6	82.8
1976							36.0	44.5	53.8	62.3	69.8	76.6
1977								36.0	44.5	53.8	62.3	69.8
1978									36.0	44.5	53.8	62.3
1979										17.6	25.0	33.1
1980											17.6	25.0
1981												17.6
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-3B (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY GAS TRUCKS 6001-8500 LBS.
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	129.2											
1964	127.8	129.2										
1965	126.4	127.8	129.2									
1966	124.9	126.4	127.8	129.2								
1967	123.3	124.9	126.4	127.8	129.2							
1968	121.7	123.3	124.9	126.4	127.8	129.2						
1969	119.9	121.7	123.3	124.9	126.4	127.8	129.2					
1970	111.3	115.2	118.8	122.1	125.3	128.3	131.2	133.8				
1971	107.3	111.3	115.2	118.8	122.1	125.3	128.3	131.2	133.8			
1972	103.0	107.3	111.3	115.2	118.8	122.1	125.3	128.3	131.2	133.8		
1973	98.5	103.0	107.3	111.3	115.2	118.8	122.1	125.3	128.3	131.2	133.8	
1974	93.6	98.5	103.0	107.3	111.3	115.2	118.8	122.1	125.3	128.3	131.2	133.8
1975	88.4	93.6	98.5	103.0	107.3	111.3	115.2	118.8	122.1	125.3	128.3	131.2
1976	82.8	88.4	93.6	98.5	103.0	107.3	111.3	115.2	118.8	122.1	125.3	128.3
1977	76.6	82.8	88.4	93.6	98.5	103.0	107.3	111.3	115.2	118.8	122.1	125.3
1978	69.8	76.6	82.8	88.4	93.6	98.5	103.0	107.3	111.3	115.2	118.8	122.1
1979	40.5	47.0	52.9	58.2	63.2	67.7	71.9	75.8	79.6	83.0	86.4	89.5
1980	33.1	40.5	47.0	52.9	58.2	63.2	67.7	71.9	75.8	79.6	83.0	86.4
1981	25.0	33.1	40.5	47.0	52.9	58.2	63.2	67.7	71.9	75.8	79.6	83.0
1982	17.6	25.0	33.1	40.5	47.0	52.9	58.2	63.2	67.7	71.9	75.8	79.6
1983		5.0	7.8	10.8	13.6	16.0	18.3	20.3	22.1	23.8	25.4	26.8
1984			5.0	7.8	10.8	13.6	16.0	18.3	20.3	22.1	23.8	25.4
1985				5.0	7.8	10.8	13.6	16.0	18.3	20.3	22.1	23.8
1986					5.0	7.8	10.8	13.6	16.0	18.3	20.3	22.1
1987						5.0	7.8	10.8	13.6	16.0	18.3	20.3
1988							5.0	7.8	10.8	13.6	16.0	18.3
1989								5.0	7.8	10.8	13.6	16.0
1990									5.0	7.8	10.8	13.6
1991										5.0	7.8	10.8
1992											5.0	7.8
1993												5.0

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-4B

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY GAS TRUCKS 6001-8500 LBS.
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	6.5						*					
1952	6.5	6.5										
1953	6.5	6.5	6.5									
1954	6.5	6.5	6.5	6.5								
1955	6.5	6.5	6.5	6.5	6.5							
1956	6.5	6.5	6.5	6.5	6.5	6.5						
1957	6.5	6.5	6.5	6.5	6.5	6.5	6.5					
1958	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5				
1959	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5			
1960	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5		
1961	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1962	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
1963	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
1964	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
1965	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
1966	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
1967	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
1968	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
1969	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
1970	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
1971		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
1972			5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
1973				5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
1974					5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
1975						5.0	5.0	5.0	5.0	5.0	5.0	5.0
1976							5.0	5.0	5.0	5.0	5.0	5.0
1977								5.0	5.0	5.0	5.0	5.0
1978									5.0	5.0	5.0	5.0
1979										1.8	1.9	2.1
1980											1.8	1.9
1981												1.8
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-4B (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR LIGHT-DUTY GAS TRUCKS 6001-8500 LBS.
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL YEAR	CALENDAR YEAR - July 1 1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	6.5											
1964	6.5	6.5										
1965	6.5	6.5	6.5									
1966	6.5	6.5	6.5	6.5								
1967	6.5	6.5	6.5	6.5	6.5							
1968	6.5	6.5	6.5	6.5	6.5	6.5						
1969	6.5	6.5	6.5	6.5	6.5	6.5	6.5					
1970	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0				
1971	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0			
1972	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		
1973	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
1974	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
1975	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
1976	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
1977	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
1978	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
1979	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.1	3.2	3.3
1980	2.1	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.1	3.2
1981	1.9	2.1	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.1
1982	1.8	1.9	2.1	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1
1983		1.8	1.9	2.1	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
1984			1.8	1.9	2.1	2.3	2.4	2.5	2.6	2.7	2.8	2.9
1985				0.5	0.8	1.2	1.5	1.7	2.0	2.2	2.4	2.6
1986					0.5	0.8	1.2	1.5	1.7	2.0	2.2	2.4
1987						0.5	0.8	1.2	1.5	1.7	2.0	2.2
1988							0.5	0.8	1.2	1.5	1.7	2.0
1989								0.5	0.8	1.2	1.5	1.7
1990									0.5	0.8	1.2	1.5
1991										0.5	0.8	1.2
1992											0.5	0.8
1993												0.5

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE II-5A

TRAVEL WEIGHTING FACTOR CALCULATION

LIGHT-DUTY GAS TRUCKS < 6000 LBS.

Vehicle Age	(a) Fraction Total Registration	(b) Annual Mileage Accumulation Rate	(a)*(b)	((a)*(b)/SUM) Travel Fraction
1	0.061	15900	969.9	0.093
2	0.095	15000	1425.0	0.136
3	0.094	14000	1316.0	0.126
4	0.103	13100	1349.3	0.129
5	0.083	12200	1012.6	0.097
6	0.076	11300	858.8	0.082
7	0.076	10300	782.8	0.075
8	0.063	9400	592.2	0.057
9	0.054	8500	459.0	0.044
10	0.043	7600	326.8	0.031
11	0.036	6700	241.2	0.023
12	0.024	6600	158.4	0.015
13	0.030	6200	186.0	0.018
14	0.028	5900	165.2	0.016
15	0.026	5500	143.0	0.014
16	0.024	5100	122.4	0.012
17	0.022	5000	110.0	0.011
18	0.020	4700	94.0	0.009
19	0.018	4400	79.2	0.008
20	0.016	4400	70.4	0.007
		SUM:	10462.2	

TABLE II-5B

TRAVEL WEIGHTING FACTOR CALCULATION

LIGHT-DUTY GAS TRUCKS 6001-8500 LBS.

Vehicle Age	(a) Fraction Total Registration	(b) Annual Mileage Accumulation Rate	(a)*(b)	((a)*(b)/SUM) Travel Fraction
1	0.037	15700	580.9	0.061
2	0.070	15700	1099.0	0.116
3	0.078	14100	1099.8	0.116
4	0.086	12600	1083.6	0.115
5	0.075	11300	847.5	0.090
6	0.075	10200	765.0	0.081
7	0.075	9400	705.0	0.075
8	0.068	8600	584.8	0.062
9	0.059	8000	472.0	0.050
10	0.053	7500	397.5	0.042
11	0.044	7100	312.4	0.033
12	0.032	6600	211.2	0.022
13	0.038	6300	239.4	0.025
14	0.036	6000	216.0	0.023
15	0.034	5500	187.0	0.020
16	0.032	5200	166.4	0.018
17	0.030	5000	150.0	0.016
18	0.028	4700	131.6	0.014
19	0.026	4400	114.4	0.012
20	0.024	4100	98.4	0.010
		SUM:	9461.9	

TABLE II-5C

AVERAGE CUMULATIVE MILEAGE
BY VEHICLE AGE - July 1

LIGHT-DUTY GAS TRUCKS < 6000 LBS.

Age (Years)	Cumulative Mileage
1	5962
2	19622
3	34369
4	48147
5	61022
6	72997
7	84044
8	94122
9	103297
10	111571
11	118946
12	125646
13	132137
14	138265
15	144062
16	149462
17	154546
18	159465
19	164090
20	168499

The methodology for calculating average cumulative mileage is presented in Appendix G.

TABLE II-5D

AVERAGE CUMULATIVE MILEAGE
BY VEHICLE AGE - July 1

LIGHT-DUTY GAS TRUCKS 6001-8500 LBS.

Age (Years)	Cumulative Mileage
1	5888
2	19625
3	34875
4	48603
5	60884
6	71916
7	81925
8	91125
9	99581
10	107459
11	114862
12	121834
13	128365
14	134590
15	140459
16	145890
17	151043
18	155965
19	160590
20	164915

The methodology for calculating average cumulative mileage is presented in Appendix G.

TABLE II-6A

General Formula for Bipstwz

The general formula for the speed-temperature-hot/cold correction factor, Bipstwz, for LIGHT-DUTY TRUCKS (0-6K GVW) is given by:

```
Bipstwz = (BAG1TERM + BAG3TERM + BAG2TERM)
          --------------------------------
                       DENOM
```

where (using * for multiplication and exp for exponential function):

```
BAG1TERM =     w    *(exp(a-b*T) + c + d*A)*(v(2,s1)/v(2,26))
BAG3TERM =     x    *(             e + f*A)*(v(g,s3)/v(g,26))
BAG2TERM = (1-w-x)*(               h + j*A)*(v(g,s2)/v(g,16))
DENOM    = (d0 + d1*A)
```

w = fraction of total miles which are driven in cold start condition
x = fraction of total miles which are driven in hot start condition
T = ambient temperature (F)
A = vehicle age minus 1, in years
g = index for model-year/region groups; see Table I-6a
s1,s2,s3 = average speeds (miles/hour) for bags 1, 2, and 3
v(g,si) = bag-specific speed correction factor; see Appendix B

and where:
a,b,c,d,e,f,h,j,d0, and d1 are constant coefficients which are functions of model-year group and pollutant, as follows:

Pol	Eqn	a	b	c	d	e	f	h	j	d0	d1
HC	1	2.9310	.014779	.673	.569	4.75	.393	5.69	.471	5.67	.67
HC	2	2.9310	.014779	-2.41	.863	2.43	.555	2.61	.597	2.80	.64
HC	3	2.4339	.023591	.623	.301	1.11	.284	1.05	.270	1.38	.28
HC	4	1.9934	.022269	-.032	.445	.497	.357	.243	.175	.54	.28
CO	1	5.6548	.015965	-14.74	9.62	42.84	5.76	57.57	7.74	56.43	7.59
CO	2	5.6548	.015965	-33.89	9.77	25.26	4.71	35.90	6.70	36.40	6.79
CO	3	5.5460	.028945	11.29	4.24	15.85	2.34	21.17	3.13	23.70	3.14
CO	4	4.2391	.017522	-.20	6.99	4.12	2.20	3.96	2.12	6.98	3.14
NOx	1	-100.	0.0	1.14	0.0	1.25	0.0	0.81	0.0	1.0	0.0
NOx	2	-100.	0.0	1.16	0.0	1.26	0.0	0.80	0.0	1.0	0.0
NOx	3	-100.	0.0	3.26	.335	2.99	.184	1.89	.116	2.47	.18
NOx	4	-100.	0.0	3.05	.318	2.88	.180	2.01	.126	2.46	.18

Eqn	Used for Model Years:	
	For HC and CO	For NOx
1	Pre-1968	Pre-1968
2	1968-1974	1968-1974
3	Post-1974	Post-1974
4	Not Used	Not Used

TABLE II-6B

General Formula for Ripstwx

The general formula for the speed-temperature-hot/cold correction factor, Ripstwx, for LIGHT-DUTY TRUCKS (6-8.5K GVW) is given by:

```
Ripstwx = (BAG1TERM + BAG3TERM + BAG2TERM)
                        DENOM
```

where (using * for multiplication and exp for exponential function):

```
BAG1TERM =     w    *(exp(a-b*T) + c + d*A)*(v(2,s1)/v(2,26))
BAG3TERM =     x    *(             e + f*A)*(v(g,s3)/v(g,26))
BAG2TERM = (1-w-x)*(               h + j*A)*(v(g,s2)/v(g,16))
DENOM    = (d0 + d1*A)
```

w = fraction of total miles which are driven in cold start condition
x = fraction of total miles which are driven in hot start condition
T = ambient temperature (F)
A = vehicle age minus 1, in years
g = index for model-year/region groups; see Table I-6a
s1,s2,s3 = average speeds (miles/hour) for bags 1, 2, and 3
v(g,si) = bag-specific speed correction factor; see Appendix B

and where:
a,b,c,d,e,f,h,j,d0, and d1 are constant coefficients which are functions of model-year group and pollutant, as follows:

Pol	Eqn	a	b	c	d	e	f	h	j	d0	d1
HC	1	2.9310	.014779	.673	.569	4.75	.393	5.69	.471	5.67	.47
HC	2	2.9310	.014779	-2.41	.863	2.43	.555	2.61	.597	2.80	.64
HC	3	2.4339	.023591	.623	.301	1.11	.284	1.05	.270	1.38	.28
HC	4	1.9934	.022269	-.032	.445	.497	.357	.243	.175	.54	.28
CO	1	5.6548	.015965	-14.74	9.62	42.84	5.76	57.57	7.74	56.43	7.59
CO	2	5.6548	.015965	-33.89	9.77	25.26	4.71	35.90	6.70	36.40	6.79
CO	3	5.5460	.028945	11.29	4.24	15.85	2.34	21.17	3.13	23.70	3.14
CO	4	4.2391	.017522	-.20	6.99	4.12	2.20	3.96	2.12	6.98	3.14
NOx	1	-100.	0.0	1.14	0.0	1.25	0.0	0.81	0.0	1.0	0.0
NOx	2	-100.	0.0	1.16	0.0	1.26	0.0	0.80	0.0	1.0	0.0
NOx	3	-100.	0.0	3.26	.335	2.99	.184	1.89	.116	2.47	.18
NOx	4	-100.	0.0	3.05	.318	2.88	.180	2.01	.126	2.46	.18

Eqn	Used for Model Years:	
	For HC and CO	For NOx
1	Not Used	Not Used
2	Pre-1979	Pre-1979
3	Post-1978	Post-1978
4	Not Used	Not Used

TABLE II-6c

Specification of Speed Terms (Vg) Used in the General Formulas for Ripstwx

LIGHT-DUTY TRUCKS (0-6K GVW)

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

Vehicle Group	Group Reference (g)
Low-Altitude Pre-1968	Group 2
Low-Altitude 1968	Group 4
Low-Altitude 1969	Group 5
Low-Altitude 1970	Group 6
Low-Altitude 1971	Group 7
Low-Altitude 1972	Group 14
Low-Altitude 1973-1974	Group 17
Low-Altitude 1975+	Group 18

TABLE II-6d

Specification of Speed Terms (V_g) Used in the General Formulas for Ripstwx

LIGHT-DUTY TRUCKS (6-8.5K GVW)

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

Vehicle Group	Group Reference (g)
Low-Altitude Pre-1979	Group 14
Low-Altitude 1979+	Group 18

TABLE II-7

IDLE EMISSION RATES

LIGHT-DUTY TRUCKS: BOTH WEIGHT CATEGORIES

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

POLLUTANT	MODEL YEAR	A (GM/MIN.)	B (GM/MIN.)
		NEW VEHICLE EMISSION RATE	DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1968	2.19	0.18
HC	1968-1969	1.20	0.20
HC	1970-1974	1.00	0.20
HC	1975-1978	0.99	0.19
HC	1979-1982	0.24	0.19
HC	1983+	0.08	0.06
CO	PRE-1968	16.58	2.55
CO	1968-1969	13.77	2.83
CO	1970-1974	14.32	2.92
CO	1975-1978	9.49	2.17
CO	1979-1982	1.82	1.56
CO	1983+	0.49	0.25
NOX	PRE-1968	0.16	0.00
NOX	1968-1969	0.24	0.00
NOX	1970-1972	0.26	0.00
NOX	1973-1974	0.19	0.00
NOX	1975-1978	0.26	0.01
NOX	1979-1984	0.18	0.01
NOX	1985+	0.04	0.02

The Idle Emission Factor is calculated from the linear equation C = a + bY, where C is the idle emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and Y = M/10000.

TABLE II-7A

IDLE EMISSION RATES

LIGHT-DUTY TRUCKS (0-6K GVW)

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

		A (GM/MIN.)	B (GM/MIN.)
POLLUTANT	MODEL YEAR	NEW VEHICLE EMISSION RATE	DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1968	2.01	0.18
HC	1968-1974	0.68	0.20
HC	1975-1978	0.28	0.19
HC	1979-1982	0.24	0.19
HC	1983+	0.08	0.06
CO	PRE-1968	16.42	2.55
CO	1968-1974	12.73	2.92
CO	1975-1978	2.02	1.56
CO	1979-1982	1.82	1.56
CO	1983+	0.49	0.25
NOX	PRE-1968	0.16	0.00
NOX	1968-1972	0.26	0.00
NOX	1973-1974	0.16	0.00
NOX	1975-1978	0.25	0.02
NOX	1979-1984	0.18	0.01
NOX	1985+	0.04	0.02

The Idle Emission Factor is calculated from the linear equation $C = a + bY$, where C is the idle emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and $Y = M/10000$.

TABLE II-7B

IDLE EMISSION RATES

LIGHT-DUTY TRUCKS (6-8.5K GVW)

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

POLLUTANT	MODEL YEAR	A (GM/MIN.) NEW VEHICLE EMISSION RATE	B (GM/MIN.) DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1970	2.93	0.18
HC	1970-1978	1.86	0.20
HC	1979-1982	0.24	0.19
HC	1983+	0.08	0.06
CO	PRE-1970	17.24	2.55
CO	1970-1978	18.62	2.92
CO	1979-1982	1.82	1.56
CO	1983+	0.49	0.25
NOX	PRE-1970	0.18	0.00
NOX	1970-1978	0.27	0.00
NOX	1979-1984	0.18	0.01
NOX	1985+	0.04	0.02

The Idle Emission Factor is calculated from the linear equation $C = a + bY$, where C is the idle emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and $Y = M/10000$.

TABLE II-8

Crankcase and Evaporative HC Emission Factors
(gm/mi)

LIGHT-DUTY TRUCKS: BOTH WEIGHT CATEGORIES

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

Model Year	0-6000 lb. Trucks(1) HC Emissions(gm/mi)	6001-8500 lb. Trucks(2) HC Emissions(gm/mi)
Pre-1963	6.63	7.70
1963-1967	3.33	7.70
1968-1970	2.53	2.53
1971-1977	1.76	2.53
1978	0.60	2.53
1979	0.60	0.60
1980+	0.15	0.15

(1) Assumes that 0-6000 lb. trucks travel an average of 3.3 trips per day and accumulate an average of 29.4 miles per day.

(2) Assumes that 6001-8500 lb. trucks travel an average of 10.9 trips per day and accumulate an average of 63.6 miles per day.

TABLE II-9

LDT Loading Correction Factor
(Additional 500 Pounds, All Model Years)

The Loading Correction Factor, L(p), is given by:

$$L(p) = u*(cf(p) - 1.0) + 1.0$$

where:

u = fraction of vehicles with additional load of 500 pounds

$cf(p)$ = correction factor values selected from table below

$L(p)$ = Loading Correction Factor

Pollutant(p)	cf(p)
HC	1.06
CO	1.20
NOx	1.03

TABLE II-10

SALES WEIGHTING DISTRIBUTION

Model Year	0-6000 lb. Truck Sales Weighting	6001-8500 lb. Truck Sales Weighting
Pre-1968	.80	.20
1968-1969	.77	.23
1970-1972	.74	.26
1973-1974	.72	.28
1975+	.55	.45

TABLE III-1

EXHAUST EMISSION RATES

HEAVY-DUTY GAS TRUCKS

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

POLLUTANT	MODEL YEAR	A (GM/MILE) NEW VEHICLE EMISSION RATE	B (GM/MILE) DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1970	23.90	0.58
HC	1970-1973	18.54	0.53
HC	1974-1978	22.02	0.53
HC	1979-1982	5.22	0.53
HC	1983+	1.46	1.06
CO	PRE-1970	272.90	3.06
CO	1970-1973	212.70	6.15
CO	1974-1978	218.80	6.15
CO	1979-1982	191.90	6.15
CO	1983+	15.38	10.54
NOx	PRE-1970	8.80	0.00
NOx	1970-1973	12.80	0.00
NOx	1974-1978	10.50	0.00
NOx	1979-1984	9.10	0.00
NOx	1985+	3.99	0.34

The Exhaust Emission Factor is calculated from the linear equation $C = a + bY$, where C is the exhaust emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and $Y = M/10000$.

TABLE III-2

MID-YEAR EXHAUST EMISSION FACTORS FOR GASOLINE-POWERED HEAVY-DUTY VEHICLES
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	35.1						*					
1952	34.8	35.1										
1953	34.5	34.8	35.1									
1954	34.3	34.5	34.8	35.1								
1955	34.0	34.3	34.5	34.8	35.1							
1956	33.7	34.0	34.3	34.5	34.8	35.1						
1957	33.3	33.7	34.0	34.3	34.5	34.8	35.1					
1958	33.0	33.3	33.7	34.0	34.3	34.5	34.8	35.1				
1959	32.6	33.0	33.3	33.7	34.0	34.3	34.5	34.8	35.1			
1960	32.1	32.6	33.0	33.3	33.7	34.0	34.3	34.5	34.8	35.1		
1961	31.6	32.1	32.6	33.0	33.3	33.7	34.0	34.3	34.5	34.8	35.1	
1962	31.1	31.6	32.1	32.6	33.0	33.3	33.7	34.0	34.3	34.5	34.8	35.1
1963	30.4	31.1	31.6	32.1	32.6	33.0	33.3	33.7	34.0	34.3	34.5	34.8
1964	29.7	30.4	31.1	31.6	32.1	32.6	33.0	33.3	33.7	34.0	34.3	34.5
1965	29.0	29.7	30.4	31.1	31.6	32.1	32.6	33.0	33.3	33.7	34.0	34.3
1966	28.1	29.0	29.7	30.4	31.1	31.6	32.1	32.6	33.0	33.3	33.7	34.0
1967	27.1	28.1	29.0	29.7	30.4	31.1	31.6	32.1	32.6	33.0	33.3	33.7
1968	26.1	27.1	28.1	29.0	29.7	30.4	31.1	31.6	32.1	32.6	33.0	33.3
1969	25.0	26.1	27.1	28.1	29.0	29.7	30.4	31.1	31.6	32.1	32.6	33.0
1970	18.8	19.5	20.5	21.5	22.4	23.2	23.9	24.5	25.1	25.6	26.0	26.5
1971		18.8	19.5	20.5	21.5	22.4	23.2	23.9	24.5	25.1	25.6	26.0
1972			18.8	19.5	20.5	21.5	22.4	23.2	23.9	24.5	25.1	25.6
1973				18.8	19.5	20.5	21.5	22.4	23.2	23.9	24.5	25.1
1974					22.3	23.0	24.0	25.0	25.8	26.6	27.4	28.0
1975						22.3	23.0	24.0	25.0	25.8	26.6	27.4
1976							22.3	23.0	24.0	25.0	25.8	26.6
1977								22.3	23.0	24.0	25.0	25.8
1978									22.3	23.0	24.0	25.0
1979										5.5	6.2	7.2
1980											5.5	6.2
1981												5.5
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE III-2 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR GASOLINE-POWERED HEAVY-DUTY VEHICLES
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	35.1											
1964	34.8	35.1										
1965	34.5	34.8	35.1									
1966	34.3	34.5	34.8	35.1								
1967	34.0	34.3	34.5	34.8	35.1							
1968	33.7	34.0	34.3	34.5	34.8	35.1						
1969	33.3	33.7	34.0	34.3	34.5	34.8	35.1					
1970	26.8	27.2	27.5	27.8	28.0	28.3	28.5	28.7				
1971	26.5	26.8	27.2	27.5	27.8	28.0	28.3	28.5	28.7			
1972	26.0	26.5	26.8	27.2	27.5	27.8	28.0	28.3	28.5	28.7		
1973	25.6	26.0	26.5	26.8	27.2	27.5	27.8	28.0	28.3	28.5	28.7	
1974	28.6	29.1	29.5	29.9	30.3	30.6	31.0	31.2	31.5	31.7	32.0	32.2
1975	28.0	28.6	29.1	29.5	29.9	30.3	30.6	31.0	31.2	31.5	31.7	32.0
1976	27.4	28.0	28.6	29.1	29.5	29.9	30.3	30.6	31.0	31.2	31.5	31.7
1977	26.6	27.4	28.0	28.6	29.1	29.5	29.9	30.3	30.6	31.0	31.2	31.5
1978	25.8	26.6	27.4	28.0	28.6	29.1	29.5	29.9	30.3	30.6	31.0	31.2
1979	8.2	9.0	9.8	10.6	11.2	11.8	12.3	12.7	13.1	13.5	13.8	14.2
1980	7.2	8.2	9.0	9.8	10.6	11.2	11.8	12.3	12.7	13.1	13.5	13.8
1981	6.2	7.2	8.2	9.0	9.8	10.6	11.2	11.8	12.3	12.7	13.1	13.5
1982	5.5	6.2	7.2	8.2	9.0	9.8	10.6	11.2	11.8	12.3	12.7	13.1
1983		2.0	3.5	5.5	7.4	9.1	10.7	12.1	13.4	14.5	15.5	16.5
1984			2.0	3.5	5.5	7.4	9.1	10.7	12.1	13.4	14.5	15.5
1985				2.0	3.5	5.5	7.4	9.1	10.7	12.1	13.4	14.5
1986					2.0	3.5	5.5	7.4	9.1	10.7	12.1	13.4
1987						2.0	3.5	5.5	7.4	9.1	10.7	12.1
1988							2.0	3.5	5.5	7.4	9.1	10.7
1989								2.0	3.5	5.5	7.4	9.1
1990									2.0	3.5	5.5	7.4
1991										2.0	3.5	5.5
1992											2.0	3.5
1993												2.0

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE III-3

MID-YEAR EXHAUST EMISSION FACTORS FOR GASOLINE-POWERED HEAVY-DUTY VEHICLES
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	331.8						*					
1952	330.5	331.8										
1953	329.0	330.5	331.8									
1954	327.6	329.0	330.5	331.8								
1955	326.1	327.6	329.0	330.5	331.8							
1956	324.5	326.1	327.6	329.0	330.5	331.8						
1957	322.7	324.5	326.1	327.6	329.0	330.5	331.8					
1958	320.7	322.7	324.5	326.1	327.6	329.0	330.5	331.8				
1959	318.6	320.7	322.7	324.5	326.1	327.6	329.0	330.5	331.8			
1960	316.2	318.6	320.7	322.7	324.5	326.1	327.6	329.0	330.5	331.8		
1961	313.6	316.2	318.6	320.7	322.7	324.5	326.1	327.6	329.0	330.5	331.8	
1962	310.6	313.6	316.2	318.6	320.7	322.7	324.5	326.1	327.6	329.0	330.5	331.8
1963	307.4	310.6	313.6	316.2	318.6	320.7	322.7	324.5	326.1	327.6	329.0	330.5
1964	303.7	307.4	310.6	313.6	316.2	318.6	320.7	322.7	324.5	326.1	327.6	329.0
1965	299.6	303.7	307.4	310.6	313.6	316.2	318.6	320.7	322.7	324.5	326.1	327.6
1966	295.0	299.6	303.7	307.4	310.6	313.6	316.2	318.6	320.7	322.7	324.5	326.1
1967	290.0	295.0	299.6	303.7	307.4	310.6	313.6	316.2	318.6	320.7	322.7	324.5
1968	284.5	290.0	295.0	299.6	303.7	307.4	310.6	313.6	316.2	318.6	320.7	322.7
1969	278.7	284.5	290.0	295.0	299.6	303.7	307.4	310.6	313.6	316.2	318.6	320.7
1970	215.6	224.4	236.0	247.0	257.1	266.3	274.6	282.0	288.6	294.4	299.7	304.5
1971		215.6	224.4	236.0	247.0	257.1	266.3	274.6	282.0	288.6	294.4	299.7
1972			215.6	224.4	236.0	247.0	257.1	266.3	274.6	282.0	288.6	294.4
1973				215.6	224.4	236.0	247.0	257.1	266.3	274.6	282.0	288.6
1974					221.7	230.5	242.1	253.1	263.2	272.4	280.7	288.1
1975						221.7	230.5	242.1	253.1	263.2	272.4	280.7
1976							221.7	230.5	242.1	253.1	263.2	272.4
1977								221.7	230.5	242.1	253.1	263.2
1978									221.7	230.5	242.1	253.1
1979										194.8	203.6	215.2
1980											194.8	203.6
1981												194.8
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE III-3 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR GASOLINE-POWERED HEAVY-DUTY VEHICLES
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	331.8											
1964	330.5	331.8										
1965	329.0	330.5	331.8									
1966	327.6	329.0	330.5	331.8								
1967	326.1	327.6	329.0	330.5	331.8							
1968	324.5	326.1	327.6	329.0	330.5	331.8						
1969	322.7	324.5	326.1	327.6	329.0	330.5	331.8					
1970	308.8	312.7	316.3	319.6	322.6	325.5	328.4	331.1				
1971	304.5	308.8	312.7	316.3	319.6	322.6	325.5	328.4	331.1			
1972	299.7	304.5	308.8	312.7	316.3	319.6	322.6	325.5	328.4	331.1		
1973	294.4	299.7	304.5	308.8	312.7	316.3	319.6	322.6	325.5	328.4	331.1	
1974	294.7	300.5	305.8	310.6	314.9	318.8	322.4	325.7	328.7	331.6	334.5	337.2
1975	288.1	294.7	300.5	305.8	310.6	314.9	318.8	322.4	325.7	328.7	331.6	334.5
1976	280.7	288.1	294.7	300.5	305.8	310.6	314.9	318.8	322.4	325.7	328.7	331.6
1977	272.4	280.7	288.1	294.7	300.5	305.8	310.6	314.9	318.8	322.4	325.7	328.7
1978	263.2	272.4	280.7	288.1	294.7	300.5	305.8	310.6	314.9	318.8	322.4	325.7
1979	226.2	236.3	245.5	253.8	261.2	267.8	273.6	278.9	283.7	288.0	291.9	295.5
1980	215.2	226.2	236.3	245.5	253.8	261.2	267.8	273.6	278.9	283.7	288.0	291.9
1981	203.6	215.2	226.2	236.3	245.5	253.8	261.2	267.8	273.6	278.9	283.7	288.0
1982	194.8	203.6	215.2	226.2	236.3	245.5	253.8	261.2	267.8	273.6	278.9	283.7
1983		20.4	35.4	55.3	74.1	91.5	107.3	121.5	134.2	145.4	155.4	164.5
1984			20.4	35.4	55.3	74.1	91.5	107.3	121.5	134.2	145.4	155.4
1985				20.4	35.4	55.3	74.1	91.5	107.3	121.5	134.2	145.4
1986					20.4	35.4	55.3	74.1	91.5	107.3	121.5	134.2
1987						20.4	35.4	55.3	74.1	91.5	107.3	121.5
1988							20.4	35.4	55.3	74.1	91.5	107.3
1989								20.4	35.4	55.3	74.1	91.5
1990									20.4	35.4	55.3	74.1
1991										20.4	35.4	55.3
1992											20.4	35.4
1993												20.4

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE III-4

MID-YEAR EXHAUST EMISSION FACTORS FOR GASOLINE-POWERED HEAVY-DUTY VEHICLES
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL YEAR	CALENDAR YEAR - July 1 1970	1971	1972	1973	1974	1975*	1976	1977	1978	1979	1980	1981
1951	8.8											
1952	8.8	8.8										
1953	8.8	8.8	8.8									
1954	8.8	8.8	8.8	8.8								
1955	8.8	8.8	8.8	8.8	8.8							
1956	8.8	8.8	8.8	8.8	8.8	8.8						
1957	8.8	8.8	8.8	8.8	8.8	8.8	8.8					
1958	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8				
1959	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8			
1960	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8		
1961	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	
1962	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
1963	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
1964	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
1965	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
1966	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
1967	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
1968	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
1969	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
1970	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
1971		12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
1972			12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
1973				12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
1974					10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
1975						10.5	10.5	10.5	10.5	10.5	10.5	10.5
1976							10.5	10.5	10.5	10.5	10.5	10.5
1977								10.5	10.5	10.5	10.5	10.5
1978									10.5	10.5	10.5	10.5
1979										9.1	9.1	9.1
1980											9.1	9.1
1981												9.1
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE III-4 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR GASOLINE-POWERED HEAVY-DUTY VEHICLES
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	8.8											
1964	8.8	8.8										
1965	8.8	8.8	8.8									
1966	8.8	8.8	8.8	8.8								
1967	8.8	8.8	8.8	8.8	8.8							
1968	8.8	8.8	8.8	8.8	8.8	8.8						
1969	8.8	8.8	8.8	8.8	8.8	8.8	8.8					
1970	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8				
1971	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8			
1972	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8		
1973	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	
1974	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
1975	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
1976	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
1977	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
1978	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
1979	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1
1980	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1
1981	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1
1982	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1
1983		9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1
1984			9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1
1985				4.2	4.6	5.3	5.9	6.4	7.0	7.4	7.8	8.2
1986					4.2	4.6	5.3	5.9	6.4	7.0	7.4	7.8
1987						4.2	4.6	5.3	5.9	6.4	7.0	7.4
1988							4.2	4.6	5.3	5.9	6.4	7.0
1989								4.2	4.6	5.3	5.9	6.4
1990									4.2	4.6	5.3	5.9
1991										4.2	4.6	5.3
1992											4.2	4.6
1993												4.2

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE III-5

TRAVEL WEIGHTING FACTOR CALCULATION

GASOLINE-POWERED HEAVY-DUTY VEHICLES

Vehicle Age	(a) Fraction Total Registration	(b) Annual Mileage Accumulation Rate	(a)*(b)	((a)*(b)/SUM) Travel Fraction
1	0.037	19000	703.0	0.061
2	0.070	19000	1330.0	0.116
3	0.078	17900	1396.2	0.122
4	0.086	16500	1419.0	0.124
5	0.075	15000	1125.0	0.098
6	0.075	13500	1012.5	0.088
7	0.075	12000	900.0	0.079
8	0.068	10600	720.8	0.063
9	0.059	9500	560.5	0.049
10	0.053	8600	455.8	0.040
11	0.044	7800	343.2	0.030
12	0.032	7000	224.0	0.020
13	0.038	6300	239.4	0.021
14	0.036	5900	212.4	0.019
15	0.034	5300	180.2	0.016
16	0.032	4900	156.8	0.014
17	0.030	4700	141.0	0.012
18	0.028	4600	128.8	0.011
19	0.026	4400	114.4	0.010
20	0.024	4200	100.8	0.009
		SUM:	11463.8	

TABLE III-5A

AVERAGE CUMULATIVE MILEAGE
BY VEHICLE AGE - July 1

GASOLINE-POWERED HEAVY-DUTY VEHICLES

Age (Years)	Cumulative Mileage
1	4750
2	19000
3	37862
4	55725
5	72212
6	87212
7	100712
8	112725
9	123362
10	132887
11	141500
12	149300
13	156312
14	162650
15	168525
16	173850
17	178775
18	183487
19	188075
20	192474

The methodology for calculating average cumulative mileage is presented in Appendix G.

TABLE III-6

SPEED CORRECTION FACTOR COEFFICIENTS FOR GASOLINE-POWERED HEAVY-DUTY VEHICLES

FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

	V = EXP(A+B*S+C*S*S)						V = A+B*S	
	HYDROCARBONS			CARBON MONOXIDE			NITROGEN OXIDES	
MODEL YEAR	A	B	C	A	B	C	A	B
PRE-1970	2.420	-0.153	0.0016	1.740	-0.117	0.0015	0.851	0.0074
1970-1973	1.140	-0.065	0.0004	1.540	-0.097	0.0010	0.812	0.0094
1974-1978	1.560	-0.096	0.0009	1.240	-0.078	0.0008	0.820	0.0081
1979+	1.540	-0.071	-0.0003	0.620	-0.039	0.0004	0.764	0.0120

TABLE III-7

IDLE EMISSION RATES

HEAVY-DUTY GAS TRUCKS

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

POLLUTANT	MODEL YEAR	A (GM/MIN.) NEW VEHICLE EMISSION RATE	B (GM/MIN.) DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1970	3.85	0.18
HC	1970-1973	0.71	0.20
HC	1974-1978	3.09	0.20
HC	1979-1982	0.73	0.20
HC	1983+	0.20	0.40
CO	PRE-1970	24.63	2.55
CO	1970-1973	15.70	2.92
CO	1974-1978	21.92	2.92
CO	1979-1982	19.23	2.92
CO	1983+	1.54	5.00
NOX	PRE-1970	0.02	0.00
NOX	1970-1973	0.04	0.00
NOX	1974-1978	0.02	0.00
NOX	1979-1984	0.02	0.00
NOX	1985+	0.01	0.00

The Idle Emission Factor is calculated from the linear equation $C = a + bY$, where C is the idle emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and $Y = M/10000$.

TABLE III-8

Crankcase and Evaporative HC Emission Factors (gm/mi)

HEAVY-DUTY GAS TRUCKS

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

Model Year	Hydrocarbon Emissions (gm/mi)
Pre-1968	7.70
1968-1980	2.00
1981+	0.30

TABLE III-9

COEFFICIENTS FOR AVG. WEIGHT AND AVG. WEIGHT/CID FOR GASOLINE-POWERED HEAVY-DUTY VEHICLES

FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL YEAR	HYDROCARBONS			CARBON MONOXIDE			NITROGEN OXIDES		
	b0	b1	b2	b0	b1	b2	b0	b1	b2
PRE-1970	1.302	0.177	-0.065	0.814	-0.036	0.016	0.869	0.172	-0.054
1970-1973	-0.584	0.124	-0.010	0.354	0.106	-0.024	0.883	0.016	-0.003
1974+	0.762	0.131	-0.047	0.320	0.149	-0.045	0.943	0.008	-0.002

$$P(ipnoq) = b0 + b1(WT/1000) + b2(WT/CID)$$

This correction factor is applicable only to gasoline-powered HDVs with weights ranging from 13000 to 29000 pounds and CID of 330 to 390.

TABLE IV-1

EXHAUST EMISSION RATES

HEAVY-DUTY DIESEL VEHICLES

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

POLLUTANT	MODEL YEAR	A (GM/MILE) NEW VEHICLE EMISSION RATE	B (GM/MILE) DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1974	4.30	0.00
HC	1974-1978	4.50	0.00
HC	1979-1982	4.50	0.00
HC	1983+	2.85	0.00
CO	PRE-1974	35.10	0.00
CO	1974-1978	27.00	0.00
CO	1979-1982	27.00	0.00
CO	1983+	27.00	0.00
NOx	PRE-1974	21.40	0.00
NOx	1974-1978	20.10	0.00
NOx	1979-1984	19.90	0.00
NOx	1985+	5.35	0.00

The Exhaust Emission Factor is calculated from the linear equation $C = a + bY$, where C is the exhaust emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and $Y = M/10000$.

TABLE IV-2

MID-YEAR EXHAUST EMISSION FACTORS FOR DIESEL-POWERED HEAVY-DUTY VEHICLES
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	4.3						*					
1952	4.3	4.3										
1953	4.3	4.3	4.3									
1954	4.3	4.3	4.3	4.3								
1955	4.3	4.3	4.3	4.3	4.3							
1956	4.3	4.3	4.3	4.3	4.3	4.3						
1957	4.3	4.3	4.3	4.3	4.3	4.3	4.3					
1958	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3				
1959	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3			
1960	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3		
1961	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	
1962	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
1963	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
1964	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
1965	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
1966	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
1967	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
1968	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
1969	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
1970	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
1971		4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
1972			4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
1973				4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
1974					4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
1975						4.5	4.5	4.5	4.5	4.5	4.5	4.5
1976							4.5	4.5	4.5	4.5	4.5	4.5
1977								4.5	4.5	4.5	4.5	4.5
1978									4.5	4.5	4.5	4.5
1979										4.5	4.5	4.5
1980											4.5	4.5
1981												4.5
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE IV-2 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR DIESEL-POWERED HEAVY-DUTY VEHICLES
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL YEAR	CALENDAR YEAR - July 1											
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	4.3											
1964	4.3	4.3										
1965	4.3	4.3	4.3									
1966	4.3	4.3	4.3	4.3								
1967	4.3	4.3	4.3	4.3	4.3							
1968	4.3	4.3	4.3	4.3	4.3	4.3						
1969	4.3	4.3	4.3	4.3	4.3	4.3	4.3					
1970	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3				
1971	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3			
1972	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3		
1973	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	
1974	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
1975	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
1976	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
1977	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
1978	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
1979	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
1980	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
1981	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
1982	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
1983		2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
1984			2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
1985				2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
1986					2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
1987						2.8	2.8	2.8	2.8	2.8	2.8	2.8
1988							2.8	2.8	2.8	2.8	2.8	2.8
1989								2.8	2.8	2.8	2.8	2.8
1990									2.8	2.8	2.8	2.8
1991										2.8	2.8	2.8
1992											2.8	2.8
1993												2.8

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE IV-3

MID-YEAR EXHAUST EMISSION FACTORS FOR DIESEL-POWERED HEAVY-DUTY VEHICLES
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	35.1						*					
1952	35.1	35.1										
1953	35.1	35.1	35.1									
1954	35.1	35.1	35.1	35.1								
1955	35.1	35.1	35.1	35.1	35.1							
1956	35.1	35.1	35.1	35.1	35.1	35.1						
1957	35.1	35.1	35.1	35.1	35.1	35.1	35.1					
1958	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1				
1959	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1			
1960	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1		
1961	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	
1962	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
1963	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
1964	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
1965	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
1966	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
1967	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
1968	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
1969	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
1970	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
1971		35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
1972			35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
1973				35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
1974					27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1975						27.0	27.0	27.0	27.0	27.0	27.0	27.0
1976							27.0	27.0	27.0	27.0	27.0	27.0
1977								27.0	27.0	27.0	27.0	27.0
1978									27.0	27.0	27.0	27.0
1979										27.0	27.0	27.0
1980											27.0	27.0
1981												27.0
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE IV-3 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR DIESEL-POWERED HEAVY-DUTY VEHICLES
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	35.1											
1964	35.1	35.1										
1965	35.1	35.1	35.1									
1966	35.1	35.1	35.1	35.1								
1967	35.1	35.1	35.1	35.1	35.1							
1968	35.1	35.1	35.1	35.1	35.1	35.1						
1969	35.1	35.1	35.1	35.1	35.1	35.1	35.1					
1970	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1				
1971	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1			
1972	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1		
1973	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	
1974	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1975	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1976	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1977	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1978	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1979	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1980	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1981	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1982	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1983		27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1984			27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1985				27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1986					27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
1987						27.0	27.0	27.0	27.0	27.0	27.0	27.0
1988							27.0	27.0	27.0	27.0	27.0	27.0
1989								27.0	27.0	27.0	27.0	27.0
1990									27.0	27.0	27.0	27.0
1991										27.0	27.0	27.0
1992											27.0	27.0
1993												27.0

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE IV-4

MID-YEAR EXHAUST EMISSION FACTORS FOR DIESEL-POWERED HEAVY-DUTY VEHICLES
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	21.4						*					
1952	21.4	21.4										
1953	21.4	21.4	21.4									
1954	21.4	21.4	21.4	21.4								
1955	21.4	21.4	21.4	21.4	21.4							
1956	21.4	21.4	21.4	21.4	21.4	21.4						
1957	21.4	21.4	21.4	21.4	21.4	21.4	21.4					
1958	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4				
1959	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4			
1960	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4		
1961	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	
1962	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4
1963	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4
1964	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4
1965	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4
1966	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4
1967	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4
1968	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4
1969	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4
1970	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4
1971		21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4
1972			21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4
1973				21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4
1974					20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1
1975						20.1	20.1	20.1	20.1	20.1	20.1	20.1
1976							20.1	20.1	20.1	20.1	20.1	20.1
1977								20.1	20.1	20.1	20.1	20.1
1978									20.1	20.1	20.1	20.1
1979										19.9	19.9	19.9
1980											19.9	19.9
1981												19.9
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE IV-4 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR DIESEL-POWERED HEAVY-DUTY VEHICLES
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	21.4											
1964	21.4	21.4										
1965	21.4	21.4	21.4									
1966	21.4	21.4	21.4	21.4								
1967	21.4	21.4	21.4	21.4	21.4							
1968	21.4	21.4	21.4	21.4	21.4	21.4						
1969	21.4	21.4	21.4	21.4	21.4	21.4	21.4					
1970	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4				
1971	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4			
1972	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4		
1973	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	21.4	
1974	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1
1975	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1
1976	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1
1977	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1
1978	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1
1979	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
1980	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
1981	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
1982	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
1983		19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
1984			19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
1985				5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
1986					5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
1987						5.3	5.3	5.3	5.3	5.3	5.3	5.3
1988							5.3	5.3	5.3	5.3	5.3	5.3
1989								5.3	5.3	5.3	5.3	5.3
1990									5.3	5.3	5.3	5.3
1991										5.3	5.3	5.3
1992											5.3	5.3
1993												5.3

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE IV-5

TRAVEL WEIGHTING FACTOR CALCULATION

DIESEL-POWERED HEAVY-DUTY VEHICLES

Vehicle Age	(a) Fraction Total Registration	(b) Annual Mileage Accumulation Rate	(a)*(b)	((a)*(b)/SUM) Travel Fraction
1	0.077	73600	5667.2	0.102
2	0.135	73600	9936.0	0.178
3	0.134	69900	9366.6	0.168
4	0.131	63300	8292.3	0.149
5	0.099	56600	5603.4	0.101
6	0.090	50000	4500.0	0.081
7	0.082	45600	3739.2	0.067
8	0.062	41200	2554.4	0.046
9	0.045	38200	1719.0	0.031
10	0.033	36000	1188.0	0.021
11	0.025	34600	865.0	0.016
12	0.015	33800	507.0	0.009
13	0.013	33100	430.3	0.008
14	0.011	32400	356.4	0.006
15	0.010	30900	309.0	0.006
16	0.008	28700	229.6	0.004
17	0.007	25700	179.9	0.003
18	0.006	21300	127.8	0.002
19	0.005	18400	92.0	0.002
20	0.004	15400	61.6	0.001
			SUM: 55724.6	

TABLE IV-5A

AVERAGE CUMULATIVE MILEAGE
BY VEHICLE AGE - July 1

DIESEL-POWERED HEAVY-DUTY VEHICLES

Age (Years)	Cumulative Mileage
1	18400
2	73600
3	146738
4	216275
5	279562
6	336175
7	386450
8	432050
9	473425
10	511725
11	547825
12	582500
13	616312
14	649412
15	681712
16	712525
17	741125
18	766650
19	788137
20	806525

The methodology for calculating average cumulative mileage is presented in Appendix G.

TABLE IV-6

SPEED CORRECTION FACTOR COEFFICIENTS FOR DIESEL-POWERED HEAVY-DUTY VEHICLES

FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

	V = EXP(A+B*S+C*S*S)								
	HYDROCARBONS			CARBON MONOXIDE			NITROGEN OXIDES		
MODEL YEAR	A	B	C	A	B	C	A	B	C
PRE-1974	0.940	-0.055	0.0004	1.440	-0.092	0.0010	0.620	-0.043	0.0006
1974-1978	0.820	-0.051	0.0005	1.200	-0.072	0.0006	0.720	-0.054	0.0009
1979+	1.200	-0.072	0.0006	1.440	-0.088	0.0008	1.000	-0.074	0.0012

TABLE IV-7

IDLE EMISSION RATES

HEAVY-DUTY DIESEL VEHICLES

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

POLLUTANT	MODEL YEAR	A (GM/MIN.) NEW VEHICLE EMISSION RATE	B (GM/MIN.) DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1974	0.50	0.00
HC	1974-1978	0.40	0.00
HC	1979-1982	0.40	0.00
HC	1983+	0.25	0.00
CO	PRE-1974	1.32	0.00
CO	1974-1978	0.66	0.00
CO	1979-1982	0.66	0.00
CO	1983+	0.66	0.00
NOX	PRE-1974	1.11	0.00
NOX	1974-1978	1.00	0.00
NOX	1979-1984	0.99	0.00
NOX	1985+	0.27	0.00

The Idle Emission Factor is calculated from the linear equation $C = a + bY$, where C is the idle emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and $Y = M/10000$.

TABLE IV-8

COEFFICIENTS FOR AVG. WEIGHT AND AVG. WEIGHT/CID FOR DIESEL-POWERED HEAVY-DUTY VEHICLES

FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL YEAR	HYDROCARBONS			CARBON MONOXIDE			NITROGEN OXIDES		
	b0	b1	b2	b0	b1	b2	b0	b1	b2
PRE-1974	2.058	-0.005	-0.014	-0.533	-0.030	0.043	0.085	0.020	0.002
1974+	0.893	0.015	-0.006	-0.299	0.030	0.003	0.138	0.023	0.001

$$P(ipnoq) = b0 + b1(WT/1000) + b2(WT/CID)$$

This correction factor is applicable only to diesel-powered HDVs with weights ranging from 19000 to 55000 pounds and CID of 540 to 600.

TABLE V-1

EXHAUST EMISSION RATES

MOTORCYCLES

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

POLLUTANT	MODEL YEAR	A (GM/MILE) NEW VEHICLE EMISSION RATE	B (GM/MILE) DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1978	8.96	1.17
HC	1978-1979	4.70	1.03
HC	1980-1982	3.82	1.03
HC	1983+	0.29	0.23
CO	PRE-1978	34.40	1.54
CO	1978-1979	20.27	4.00
CO	1980-1982	14.86	4.00
CO	1983+	2.71	2.00
NOx	PRE-1978	0.14	0.00
NOx	1978-1979	0.28	0.00
NOx	1980-1984	0.56	0.00
NOx	1985+	0.04	0.22

The Exhaust Emission Factor is calculated from the linear equation $C = a + bY$, where C is the exhaust emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and $Y = M/10000$.

TABLE V-2

MID-YEAR EXHAUST EMISSION FACTORS FOR MOTORCYCLES
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL YEAR	CALENDAR YEAR - July 1 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	12.4						*					
1952	12.2	12.4										
1953	12.1	12.2	12.4									
1954	11.9	12.1	12.2	12.4								
1955	11.8	11.9	12.1	12.2	12.4							
1956	11.6	11.8	11.9	12.1	12.2	12.4						
1957	11.5	11.6	11.8	11.9	12.1	12.2	12.4					
1958	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4				
1959	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4			
1960	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4		
1961	10.9	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4	
1962	10.7	10.9	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4
1963	10.5	10.7	10.9	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2
1964	10.3	10.5	10.7	10.9	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1
1965	10.1	10.3	10.5	10.7	10.9	11.0	11.2	11.3	11.5	11.6	11.8	11.9
1966	9.9	10.1	10.3	10.5	10.7	10.9	11.0	11.2	11.3	11.5	11.6	11.8
1967	9.7	9.9	10.1	10.3	10.5	10.7	10.9	11.0	11.2	11.3	11.5	11.6
1968	9.5	9.7	9.9	10.1	10.3	10.5	10.7	10.9	11.0	11.2	11.3	11.5
1969	9.2	9.5	9.7	9.9	10.1	10.3	10.5	10.7	10.9	11.0	11.2	11.3
1970	9.0	9.2	9.5	9.7	9.9	10.1	10.3	10.5	10.7	10.9	11.0	11.2
1971		9.0	9.2	9.5	9.7	9.9	10.1	10.3	10.5	10.7	10.9	11.0
1972			9.0	9.2	9.5	9.7	9.9	10.1	10.3	10.5	10.7	10.9
1973				9.0	9.2	9.5	9.7	9.9	10.1	10.3	10.5	10.7
1974					9.0	9.2	9.5	9.7	9.9	10.1	10.3	10.5
1975						9.0	9.2	9.5	9.7	9.9	10.1	10.3
1976							9.0	9.2	9.5	9.7	9.9	10.1
1977								9.0	9.2	9.5	9.7	9.9
1978									4.8	4.9	5.2	5.4
1979										4.8	4.9	5.2
1980											3.9	4.0
1981												3.9
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE V-2 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR MOTORCYCLES
HYDROCARBONS (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL YEAR	CALENDAR YEAR - July 1 1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	12.4											
1964	12.2	12.4										
1965	12.1	12.2	12.4									
1966	11.9	12.1	12.2	12.4								
1967	11.8	11.9	12.1	12.2	12.4							
1968	11.6	11.8	11.9	12.1	12.2	12.4						
1969	11.5	11.6	11.8	11.9	12.1	12.2	12.4					
1970	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4				
1971	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4			
1972	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4		
1973	10.9	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4	
1974	10.7	10.9	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4
1975	10.5	10.7	10.9	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2
1976	10.3	10.5	10.7	10.9	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1
1977	10.1	10.3	10.5	10.7	10.9	11.0	11.2	11.3	11.5	11.6	11.8	11.9
1978	5.6	5.7	5.9	6.1	6.2	6.4	6.5	6.7	6.8	6.9	7.1	7.2
1979	5.4	5.6	5.7	5.9	6.1	6.2	6.4	6.5	6.7	6.8	6.9	7.1
1980	4.3	4.5	4.7	4.9	5.0	5.2	5.3	5.5	5.6	5.8	5.9	6.0
1981	4.0	4.3	4.5	4.7	4.9	5.0	5.2	5.3	5.5	5.6	5.8	5.9
1982	3.9	4.0	4.3	4.5	4.7	4.9	5.0	5.2	5.3	5.5	5.6	5.8
1983		0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7
1984			0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.7
1985				0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6
1986					0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6
1987						0.3	0.3	0.4	0.4	0.5	0.5	0.6
1988							0.3	0.3	0.4	0.4	0.5	0.5
1989								0.3	0.3	0.4	0.4	0.5
1990									0.3	0.3	0.4	0.4
1991										0.3	0.3	0.4
1992											0.3	0.3
1993												0.3

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE V-3

MID-YEAR EXHAUST EMISSION FACTORS FOR MOTORCYCLES
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL YEAR	CALENDAR YEAR - July 1 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	38.9						*					
1952	38.7	38.9										
1953	38.5	38.7	38.9									
1954	38.3	38.5	38.7	38.9								
1955	38.1	38.3	38.5	38.7	38.9							
1956	37.9	38.1	38.3	38.5	38.7	38.9						
1957	37.7	37.9	38.1	38.3	38.5	38.7	38.9					
1958	37.5	37.7	37.9	38.1	38.3	38.5	38.7	38.9				
1959	37.3	37.5	37.7	37.9	38.1	38.3	38.5	38.7	38.9			
1960	37.1	37.3	37.5	37.7	37.9	38.1	38.3	38.5	38.7	38.9		
1961	36.9	37.1	37.3	37.5	37.7	37.9	38.1	38.3	38.5	38.7	38.9	
1962	36.7	36.9	37.1	37.3	37.5	37.7	37.9	38.1	38.3	38.5	38.7	38.9
1963	36.5	36.7	36.9	37.1	37.3	37.5	37.7	37.9	38.1	38.3	38.5	38.7
1964	36.2	36.5	36.7	36.9	37.1	37.3	37.5	37.7	37.9	38.1	38.3	38.5
1965	36.0	36.2	36.5	36.7	36.9	37.1	37.3	37.5	37.7	37.9	38.1	38.3
1966	35.7	36.0	36.2	36.5	36.7	36.9	37.1	37.3	37.5	37.7	37.9	38.1
1967	35.4	35.7	36.0	36.2	36.5	36.7	36.9	37.1	37.3	37.5	37.7	37.9
1968	35.1	35.4	35.7	36.0	36.2	36.5	36.7	36.9	37.1	37.3	37.5	37.7
1969	34.7	35.1	35.4	35.7	36.0	36.2	36.5	36.7	36.9	37.1	37.3	37.5
1970	34.5	34.7	35.1	35.4	35.7	36.0	36.2	36.5	36.7	36.9	37.1	37.3
1971		34.5	34.7	35.1	35.4	35.7	36.0	36.2	36.5	36.7	36.9	37.1
1972			34.5	34.7	35.1	35.4	35.7	36.0	36.2	36.5	36.7	36.9
1973				34.5	34.7	35.1	35.4	35.7	36.0	36.2	36.5	36.7
1974					34.5	34.7	35.1	35.4	35.7	36.0	36.2	36.5
1975						34.5	34.7	35.1	35.4	35.7	36.0	36.2
1976							34.5	34.7	35.1	35.4	35.7	36.0
1977								34.5	34.7	35.1	35.4	35.7
1978									20.5	21.1	22.1	22.9
1979										20.5	21.1	22.1
1980											15.1	15.7
1981												15.1
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE V-3 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR MOTORCYCLES
CARBON MONOXIDE (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL	CALENDAR YEAR - July 1											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	38.9											
1964	38.7	38.9										
1965	38.5	38.7	38.9									
1966	38.3	38.5	38.7	38.9								
1967	38.1	38.3	38.5	38.7	38.9							
1968	37.9	38.1	38.3	38.5	38.7	38.9						
1969	37.7	37.9	38.1	38.3	38.5	38.7	38.9					
1970	37.5	37.7	37.9	38.1	38.3	38.5	38.7	38.9				
1971	37.3	37.5	37.7	37.9	38.1	38.3	38.5	38.7	38.9			
1972	37.1	37.3	37.5	37.7	37.9	38.1	38.3	38.5	38.7	38.9		
1973	36.9	37.1	37.3	37.5	37.7	37.9	38.1	38.3	38.5	38.7	38.9	
1974	36.7	36.9	37.1	37.3	37.5	37.7	37.9	38.1	38.3	38.5	38.7	38.9
1975	36.5	36.7	36.9	37.1	37.3	37.5	37.7	37.9	38.1	38.3	38.5	38.7
1976	36.2	36.5	36.7	36.9	37.1	37.3	37.5	37.7	37.9	38.1	38.3	38.5
1977	36.0	36.2	36.5	36.7	36.9	37.1	37.3	37.5	37.7	37.9	38.1	38.3
1978	23.6	24.3	25.0	25.6	26.2	26.8	27.3	27.9	28.4	28.9	29.4	29.9
1979	22.9	23.6	24.3	25.0	25.6	26.2	26.8	27.3	27.9	28.4	28.9	29.4
1980	16.6	17.5	18.2	18.9	19.6	20.2	20.8	21.4	21.9	22.5	23.0	23.5
1981	15.7	16.6	17.5	18.2	18.9	19.6	20.2	20.8	21.4	21.9	22.5	23.0
1982	15.1	15.7	16.6	17.5	18.2	18.9	19.6	20.2	20.8	21.4	21.9	22.5
1983		2.8	3.1	3.6	4.0	4.4	4.7	5.1	5.4	5.7	6.0	6.2
1984			2.8	3.1	3.6	4.0	4.4	4.7	5.1	5.4	5.7	6.0
1985				2.8	3.1	3.6	4.0	4.4	4.7	5.1	5.4	5.7
1986					2.8	3.1	3.6	4.0	4.4	4.7	5.1	5.4
1987						2.8	3.1	3.6	4.0	4.4	4.7	5.1
1988							2.8	3.1	3.6	4.0	4.4	4.7
1989								2.8	3.1	3.6	4.0	4.4
1990									2.8	3.1	3.6	4.0
1991										2.8	3.1	3.6
1992											2.8	3.1
1993												2.8

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE V-4

MID-YEAR EXHAUST EMISSION FACTORS FOR MOTORCYCLES
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL YEAR	CALENDAR YEAR - July 1 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1951	0.1						*					
1952	0.1	0.1										
1953	0.1	0.1	0.1									
1954	0.1	0.1	0.1	0.1								
1955	0.1	0.1	0.1	0.1	0.1							
1956	0.1	0.1	0.1	0.1	0.1	0.1						
1957	0.1	0.1	0.1	0.1	0.1	0.1	0.1					
1958	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
1959	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1			
1960	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
1961	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
1962	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1963	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1964	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1965	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1966	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1967	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1968	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1969	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1970	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1971		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1972			0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1973				0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1974					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1975						0.1	0.1	0.1	0.1	0.1	0.1	0.1
1976							0.1	0.1	0.1	0.1	0.1	0.1
1977								0.1	0.1	0.1	0.1	0.1
1978									0.3	0.3	0.3	0.3
1979										0.3	0.3	0.3
1980											0.6	0.6
1981												0.6
1982												
1983												
1984												
1985												
1986												
1987												
1988												
1989												
1990												

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE V-4 (FOR CALENDAR YEARS 1982-1993)

MID-YEAR EXHAUST EMISSION FACTORS FOR MOTORCYCLES
NITROGEN OXIDES (GM/MI)
FOR ALL REGIONS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

MODEL YEAR	CALENDAR YEAR - July 1 1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1963	0.1											
1964	0.1	0.1										
1965	0.1	0.1	0.1									
1966	0.1	0.1	0.1	0.1								
1967	0.1	0.1	0.1	0.1	0.1							
1968	0.1	0.1	0.1	0.1	0.1	0.1						
1969	0.1	0.1	0.1	0.1	0.1	0.1	0.1					
1970	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
1971	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1			
1972	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
1973	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
1974	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
1975	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1976	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1977	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1978	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
1979	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
1980	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
1981	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
1982	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
1983		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
1984			0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
1985				0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4
1986					0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3
1987						0.1	0.1	0.1	0.2	0.2	0.3	0.3
1988							0.1	0.1	0.1	0.2	0.2	0.3
1989								0.1	0.1	0.1	0.2	0.2
1990									0.1	0.1	0.1	0.2
1991										0.1	0.1	0.1
1992											0.1	0.1
1993												0.1

*EMISSION FACTORS FOR VEHICLES THROUGH MODEL YEAR 1975 AND THROUGH CALENDAR YEAR 1975 ARE BASED ON ACTUAL TESTS OF IN-USE VEHICLES. POST-1975 CALENDAR YEAR EMISSION FACTORS FOR ALL VEHICLES ARE PROJECTED.

TABLE V-5

TRAVEL WEIGHTING FACTOR CALCULATION

MOTORCYCLES

Vehicle Age	(a) Fraction Total Registration	(b) Annual Mileage Accumulation Rate	(a)*(b)	((a)*(b)/SUM) Travel Fraction
1	0.105	2010	211.0	0.107
2	0.225	2510	564.7	0.286
3	0.206	2070	426.4	0.216
4	0.149	1850	275.6	0.140
5	0.097	1720	166.8	0.085
6	0.062	1620	100.4	0.051
7	0.046	1550	71.3	0.036
8	0.033	1490	49.2	0.025
9	0.029	1430	41.5	0.021
10	0.023	1390	32.0	0.016
11	0.008	1350	10.8	0.005
12	0.005	1320	6.6	0.003
13	0.013	1290	16.8	0.008
14	0.000	0	0.0	0.000
15	0.000	0	0.0	0.000
16	0.000	0	0.0	0.000
17	0.000	0	0.0	0.000
18	0.000	0	0.0	0.000
19	0.000	0	0.0	0.000
20	0.000	0	0.0	0.000
		SUM:	1973.2	

TABLE V-5A

AVERAGE CUMULATIVE MILEAGE
BY VEHICLE AGE - July 1

MOTORCYCLES

Age (Years)	Cumulative Mileage
1	503
2	2073
3	4465
4	6563
5	8424
6	10147
7	11771
8	13322
9	14812
10	16245
11	17635
12	18986
13	20306
14	21597
15	22867
16	24117
17	25349
18	26569
19	27779
20	28979

The methodology for calculating average cumulative mileage is presented in Appendix G.

TABLE V-6

General Formula for Ripstwx

The general formula for the speed-temperature-hot/cold correction factor, Ripstwx, for MOTORCYCLES is given by:

$$\text{Ripstwx} = \frac{\text{(BAG1TERM + BAG3TERM + BAG2TERM)}}{\text{DENOM}}$$

where (using * for multiplication and exp for exponential function):

```
BAG1TERM =     w    *(exp(a-b*T)  + c + d*A)*(v(2,s1)/v(2,26))
BAG3TERM =     x    *(                e + f*A)*(v(g,s3)/v(g,26))
BAG2TERM = (1-w-x)*(                h + j*A)*(v(g,s2)/v(g,16))
DENOM    = (d0 + d1*A)
```

w = fraction of total miles which are driven in cold start condition
x = fraction of total miles which are driven in hot start condition
T = ambient temperature (F)
A = vehicle age minus 1, in years
g = index for model-year/region groups; see Table I-6a
s1,s2,s3 = average speeds (miles/hour) for bags 1, 2, and 3
v(g,si) = bag-specific speed correction factor; see Appendix B

and where:
a,b,c,d,e,f,h,j,d0, and d1 are constant coefficients which are functions of model-year group and pollutant, as follows:

Pol	Eqn	a	b	c	d	e	f	h	j	d0	d1
HC	1	2.9310	.014779	.673	.569	4.75	.393	5.69	.471	5.67	.47
HC	2	2.9310	.014779	-2.41	.863	2.43	.555	2.61	.597	2.80	.64
HC	3	2.4339	.023591	.623	.301	1.11	.284	1.05	.270	1.38	.28
HC	4	1.9934	.022269	-.032	.445	.497	.357	.243	.175	.54	.28
CO	1	5.6548	.015965	-14.74	9.62	42.84	5.76	57.57	7.74	56.43	7.59
CO	2	5.6548	.015965	-33.89	9.77	25.26	4.71	35.90	6.70	36.40	6.79
CO	3	5.5460	.028945	11.29	4.24	15.85	2.34	21.17	3.13	23.70	3.14
CO	4	4.2391	.017522	-.20	6.99	4.12	2.20	3.96	2.12	6.98	3.14
NOx	1	-100.	0.0	1.14	0.0	1.25	0.0	0.81	0.0	1.0	0.0
NOx	2	-100.	0.0	1.16	0.0	1.26	0.0	0.80	0.0	1.0	0.0
NOx	3	-100.	0.0	3.26	.335	2.99	.184	1.89	.116	2.47	.18
NOx	4	-100.	0.0	3.05	.318	2.88	.180	2.01	.126	2.46	.18

Eqn	Used for Model Years:	
	For HC and CO	For NOx
1	Pre-1978	Pre-1978
2	Post-1977	Post-1977
3	Not Used	Not Used
4	Not Used	Not Used

TABLE V-6a

Specification of Speed Terms (Vg) Used in the General Formulas for Bipstwx

MOTORCYCLES

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

Vehicle Group	Group Reference (g)
Low-Altitude Pre-1978	Group 2
Low-Altitude 1978+	Group 17

TABLE V-7

IDLE EMISSION RATES

MOTORCYCLES

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

POLLUTANT	MODEL YEAR	A (GM/MIN.) NEW VEHICLE EMISSION RATE	B (GM/MIN.) DETERIORATION RATE (PER 10,000 MILES)
HC	PRE-1978	4.05	0.36
HC	1978-1979	2.12	0.62
HC	1980-1982	1.72	0.62
HC	1983+	0.13	0.10
CO	PRE-1978	8.27	1.28
CO	1978-1979	4.87	1.12
CO	1980-1982	3.57	1.12
CO	1983+	0.65	0.48
NOX	PRE-1978	0.01	0.00
NOX	1978-1979	0.02	0.00
NOX	1980-1984	0.04	0.00
NOX	1985+	0.01	0.01

The Idle Emission Factor is calculated from the linear equation $C = a + bY$, where C is the idle emission factor for a vehicle with cumulative mileage M, a and b are the factors listed in the above table, and $Y = M/10000$.

TABLE V-8

Crankcase and Evaporative HC Emission Factors (gm/mi)

MOTORCYCLES

FOR ALL AREAS EXCEPT CALIFORNIA AND HIGH-ALTITUDE

Model Year	Hydrocarbon Emissions (gm/mi)
Pre-1978	1.60

APPENDIX A

Selected Speed Correction Factors

Group Definitions

Group Number	Group Definition
Group 1	Pre-controlled, High-altitude
Group 2	Pre-controlled Low-altitude
Group 3	1966-1967 California
Group 4	1968 Low-altitude
Group 5	1969 Low-altitude
Group 6	1970 Low-altitude
Group 7	1971 Low-altitude
Group 8	1968 High-altitude
Group 9	1969 High-altitude
Group 10	1970 High-altitude
Group 11	1971 High-altitude
Group 12	1972 High-altitude
Group 13	1972 California
Group 14	1972 Low-altitude
Group 15	1973-1974 High-altitude
Group 16	1973-1974 California
Group 17	1973-1974 Low-altitude
Group 18	1975 and later, all areas

SELECTED SPEED CORRECTION FACTORS - v(g,s)

		SPEED (MPH)											
POL	GR	5.0	10.	15.	20.	25.	30.	35.	40.	45.	50.	55.	60.
HC	1	3.107	1.679	1.201	0.987	0.859	0.761	0.684	0.629	0.598	0.585	0.571	0.516
HC	2	3.297	1.749	1.224	0.986	0.844	0.740	0.659	0.600	0.564	0.547	0.530	0.481
HC	3	3.083	1.708	1.218	0.985	0.840	0.732	0.649	0.590	0.553	0.531	0.500	0.426
HC	4	3.470	1.808	1.246	0.984	0.821	0.700	0.606	0.538	0.497	0.472	0.445	0.381
HC	5	3.419	1.773	1.231	0.985	0.834	0.720	0.630	0.565	0.526	0.504	0.479	0.414
HC	6	3.123	1.694	1.208	0.987	0.853	0.754	0.677	0.622	0.590	0.575	0.556	0.494
HC	7	3.160	1.709	1.215	0.986	0.845	0.740	0.658	0.600	0.567	0.551	0.528	0.459
HC	8	2.700	1.548	1.160	0.991	0.890	0.813	0.750	0.706	0.685	0.683	0.678	0.622
HC	9	2.902	1.599	1.169	0.988	0.889	0.817	0.759	0.716	0.693	0.688	0.683	0.640
HC	10	3.040	1.650	1.191	0.990	0.870	0.778	0.705	0.653	0.625	0.615	0.603	0.546
HC	11	2.798	1.571	1.169	0.990	0.878	0.789	0.717	0.668	0.646	0.640	0.619	0.528
HC	12	2.928	1.624	1.186	0.990	0.873	0.785	0.714	0.664	0.639	0.632	0.622	0.563
HC	13	2.705	1.547	1.164	0.987	0.869	0.770	0.690	0.636	0.611	0.604	0.581	0.485
HC	14	3.276	1.726	1.217	0.986	0.845	0.736	0.651	0.590	0.555	0.539	0.520	0.457
HC	15	2.815	1.582	1.172	0.990	0.877	0.789	0.719	0.671	0.648	0.644	0.632	0.557
HC	16	2.763	1.576	1.181	0.989	0.849	0.731	0.637	0.575	0.546	0.534	0.501	0.387
HC	17	3.963	1.931	1.285	0.981	0.784	0.635	0.523	0.447	0.401	0.373	0.337	0.258
HC	18	3.194	1.708	1.228	0.984	0.803	0.653	0.540	0.468	0.433	0.416	0.375	0.261
CO	1	2.389	1.463	1.142	0.991	0.889	0.803	0.733	0.686	0.666	0.664	0.648	0.559
CO	2	3.319	1.751	1.225	0.986	0.841	0.733	0.650	0.591	0.556	0.538	0.517	0.453
CO	3	3.656	1.857	1.251	0.985	0.838	0.738	0.664	0.609	0.574	0.555	0.544	0.517
CO	4	3.621	1.845	1.253	0.984	0.824	0.707	0.619	0.556	0.517	0.493	0.465	0.399
CO	5	4.554	2.120	1.329	0.979	0.780	0.644	0.543	0.469	0.417	0.384	0.358	0.323
CO	6	4.511	2.103	1.326	0.979	0.777	0.637	0.532	0.457	0.407	0.374	0.345	0.299
CO	7	4.174	2.003	1.299	0.975	0.776	0.633	0.527	0.453	0.406	0.376	0.341	0.273
CO	8	2.345	1.418	1.121	0.992	0.905	0.826	0.760	0.716	0.702	0.710	0.700	0.599
CO	9	2.277	1.395	1.113	0.993	0.912	0.840	0.779	0.742	0.736	0.754	0.756	0.661
CO	10	2.541	1.488	1.149	0.990	0.873	0.769	0.684	0.628	0.607	0.607	0.588	0.477
CO	11	2.516	1.474	1.148	0.989	0.863	0.746	0.650	0.590	0.566	0.564	0.531	0.394
CO	12	2.885	1.540	1.149	0.991	0.892	0.805	0.730	0.679	0.659	0.660	0.646	0.542
CO	13	3.791	1.916	1.291	0.980	0.771	0.612	0.496	0.420	0.378	0.354	0.323	0.245
CO	14	4.056	1.950	1.281	0.982	0.804	0.675	0.578	0.510	0.470	0.452	0.437	0.392
CO	15	2.599	1.459	1.127	0.992	0.900	0.814	0.739	0.690	0.675	0.681	0.660	0.529
CO	16	3.386	1.746	1.239	0.985	0.797	0.643	0.529	0.460	0.428	0.412	0.361	0.228
CO	17	4.239	1.980	1.293	0.981	0.782	0.634	0.525	0.454	0.415	0.395	0.364	0.279
CO	18	2.988	1.581	1.183	0.986	0.821	0.671	0.557	0.492	0.475	0.477	0.433	0.264
NOx	1	1.505	1.060	0.940	1.009	1.161	1.319	1.439	1.510	1.549	1.606	1.761	2.126
NOx	2	1.242	1.031	0.974	1.004	1.073	1.146	1.203	1.239	1.265	1.306	1.404	1.615
NOx	3	0.990	0.946	0.960	1.004	1.058	1.109	1.150	1.182	1.213	1.258	1.341	1.490
NOx	4	1.063	0.992	0.980	1.003	1.038	1.075	1.105	1.129	1.152	1.189	1.257	1.384
NOx	5	0.978	0.970	0.981	1.002	1.026	1.049	1.070	1.091	1.115	1.151	1.208	1.298
NOx	6	0.927	0.924	0.956	1.004	1.056	1.102	1.141	1.173	1.206	1.250	1.323	1.445
NOx	7	1.003	0.949	0.960	1.004	1.059	1.110	1.150	1.180	1.207	1.250	1.331	1.483
NOx	8	1.284	1.006	0.944	1.008	1.128	1.255	1.359	1.429	1.477	1.531	1.641	1.877
NOx	9	1.143	0.967	0.944	1.007	1.105	1.201	1.275	1.323	1.358	1.406	1.511	1.733
NOx	10	1.324	0.998	0.930	1.010	1.153	1.298	1.411	1.481	1.526	1.584	1.723	2.034
NOx	11	1.181	0.981	0.946	1.007	1.109	1.214	1.300	1.361	1.407	1.463	1.570	1.787
NOx	12	1.014	0.860	0.887	1.012	1.174	1.330	1.454	1.542	1.606	1.678	1.810	2.070
NOx	13	0.589	0.806	0.934	1.004	1.043	1.070	1.097	1.132	1.175	1.221	1.258	1.268
NOx	14	0.999	0.903	0.924	1.008	1.112	1.209	1.282	1.332	1.370	1.421	1.526	1.737
NOx	15	1.082	0.907	0.909	1.010	1.148	1.280	1.382	1.451	1.501	1.563	1.691	1.954
NOx	16	0.856	0.943	0.986	1.001	1.002	1.000	1.002	1.014	1.036	1.067	1.103	1.136
NOx	17	0.808	0.864	0.934	1.006	1.069	1.121	1.161	1.193	1.226	1.274	1.353	1.486
NOx	18	0.816	0.819	0.897	1.009	1.124	1.222	1.294	1.344	1.386	1.446	1.560	1.777

SELECTED SPEED CORRECTION FACTORS - v(g,s)

		SPEED (MPH)											
POL	GR	6.0	11.	16.	21.	26.	31.	36.	41.	46.	51.	56.	61.
HC	1	2.662	1.544	1.146	0.957	0.837	0.744	0.671	0.621	0.594	0.583	0.565	0.496
HC	2	2.816	1.601	1.163	0.953	0.821	0.722	0.645	0.591	0.560	0.544	0.524	0.464
HC	3	2.662	1.572	1.159	0.951	0.816	0.713	0.635	0.581	0.548	0.526	0.490	0.403
HC	4	2.951	1.650	1.180	0.947	0.795	0.679	0.590	0.528	0.491	0.468	0.436	0.361
HC	5	2.901	1.620	1.168	0.950	0.809	0.700	0.615	0.555	0.520	0.500	0.471	0.393
HC	6	2.680	1.558	1.151	0.956	0.831	0.737	0.664	0.614	0.586	0.573	0.549	0.473
HC	7	2.709	1.571	1.156	0.954	0.822	0.722	0.644	0.592	0.563	0.548	0.520	0.436
HC	8	2.343	1.438	1.116	0.968	0.874	0.799	0.740	0.700	0.683	0.683	0.673	0.599
HC	9	2.497	1.477	1.122	0.964	0.873	0.804	0.749	0.710	0.691	0.688	0.679	0.622
HC	10	2.605	1.520	1.139	0.962	0.850	0.762	0.693	0.646	0.622	0.614	0.597	0.524
HC	11	2.413	1.457	1.123	0.964	0.859	0.773	0.705	0.662	0.644	0.638	0.609	0.496
HC	12	2.523	1.500	1.135	0.963	0.854	0.769	0.702	0.657	0.636	0.631	0.616	0.541
HC	13	2.342	1.439	1.120	0.961	0.848	0.753	0.677	0.629	0.608	0.602	0.570	0.452
HC	14	2.788	1.582	1.158	0.954	0.821	0.717	0.637	0.581	0.551	0.536	0.512	0.435
HC	15	2.431	1.466	1.125	0.964	0.858	0.774	0.707	0.664	0.646	0.644	0.624	0.530
HC	16	2.389	1.465	1.134	0.958	0.824	0.710	0.622	0.567	0.543	0.531	0.487	0.352
HC	17	3.309	1.748	1.209	0.937	0.751	0.610	0.505	0.435	0.395	0.368	0.326	0.235
HC	18	2.717	1.573	1.169	0.945	0.771	0.627	0.522	0.459	0.429	0.411	0.359	0.229
CO	1	2.105	1.373	1.104	0.968	0.871	0.788	0.721	0.680	0.665	0.663	0.638	0.527
CO	2	2.829	1.602	1.163	0.952	0.817	0.715	0.636	0.582	0.552	0.535	0.509	0.432
CO	3	3.096	1.685	1.181	0.950	0.815	0.722	0.651	0.600	0.569	0.553	0.541	0.507
CO	4	3.063	1.678	1.184	0.946	0.798	0.688	0.605	0.547	0.511	0.489	0.456	0.379
CO	5	3.784	1.896	1.238	0.932	0.749	0.621	0.526	0.457	0.409	0.378	0.352	0.313
CO	6	3.745	1.882	1.237	0.931	0.746	0.613	0.515	0.445	0.399	0.369	0.338	0.285
CO	7	3.482	1.804	1.217	0.929	0.744	0.609	0.509	0.441	0.399	0.370	0.331	0.254
CO	8	2.054	1.333	1.088	0.973	0.889	0.812	0.749	0.711	0.703	0.711	0.690	0.562
CO	9	2.001	1.313	1.082	0.975	0.898	0.827	0.770	0.738	0.739	0.758	0.747	0.623
CO	10	2.208	1.392	1.110	0.965	0.852	0.750	0.670	0.622	0.606	0.607	0.576	0.440
CO	11	2.183	1.381	1.110	0.963	0.839	0.724	0.635	0.582	0.565	0.562	0.514	0.352
CO	12	2.447	1.425	1.107	0.969	0.874	0.788	0.717	0.672	0.658	0.661	0.635	0.505
CO	13	3.196	1.742	1.215	0.933	0.735	0.585	0.477	0.409	0.372	0.350	0.312	0.222
CO	14	3.383	1.759	1.204	0.941	0.775	0.653	0.562	0.500	0.465	0.449	0.432	0.376
CO	15	2.228	1.361	1.092	0.972	0.882	0.797	0.727	0.684	0.675	0.681	0.645	0.485
CO	16	2.850	1.603	1.178	0.944	0.763	0.617	0.511	0.451	0.425	0.406	0.342	0.194
CO	17	3.500	1.783	1.214	0.935	0.749	0.609	0.508	0.444	0.411	0.391	0.353	0.253
CO	18	2.516	1.465	1.137	0.952	0.789	0.644	0.540	0.486	0.475	0.475	0.410	0.220
NOx	1	1.382	1.015	0.943	1.036	1.193	1.347	1.458	1.520	1.557	1.626	1.813	2.236
NOx	2	1.184	1.010	0.975	1.016	1.089	1.159	1.211	1.244	1.271	1.320	1.435	1.677
NOx	3	0.975	0.945	0.967	1.015	1.069	1.118	1.157	1.188	1.220	1.271	1.364	1.530
NOx	4	1.043	0.986	0.983	1.009	1.046	1.081	1.110	1.133	1.158	1.199	1.277	1.419
NOx	5	0.975	0.971	0.985	1.006	1.030	1.053	1.074	1.095	1.121	1.160	1.223	1.321
NOx	6	0.923	0.929	0.965	1.014	1.065	1.111	1.148	1.179	1.213	1.262	1.343	1.478
NOx	7	0.985	0.947	0.967	1.015	1.070	1.119	1.157	1.185	1.214	1.262	1.354	1.525
NOx	8	1.206	0.980	0.949	1.029	1.154	1.278	1.376	1.440	1.486	1.546	1.675	1.947
NOx	9	1.092	0.952	0.951	1.025	1.125	1.217	1.286	1.331	1.365	1.421	1.544	1.798
NOx	10	1.232	0.967	0.937	1.036	1.183	1.324	1.428	1.491	1.534	1.603	1.768	2.126
NOx	11	1.124	0.964	0.953	1.025	1.130	1.233	1.314	1.371	1.416	1.478	1.603	1.849
NOx	12	0.964	0.854	0.906	1.043	1.207	1.358	1.475	1.556	1.618	1.698	1.849	2.145
NOx	13	0.642	0.837	0.951	1.014	1.049	1.075	1.103	1.140	1.184	1.229	1.263	1.265
NOx	14	0.967	0.900	0.937	1.028	1.133	1.225	1.294	1.340	1.378	1.436	1.558	1.797
NOx	15	1.028	0.896	0.924	1.036	1.175	1.303	1.399	1.462	1.511	1.582	1.730	2.030
NOx	16	0.878	0.954	0.990	1.001	1.001	1.000	1.004	1.017	1.042	1.074	1.110	1.141
NOx	17	0.817	0.877	0.949	1.019	1.081	1.130	1.168	1.199	1.234	1.287	1.375	1.521
NOx	18	0.808	0.830	0.918	1.033	1.145	1.238	1.306	1.352	1.396	1.463	1.594	1.838

APPENDIX B

Coefficients for the Normalized Equations for Speed Correction Factors

Normalized Equations for Speed Correction Values v(g,s)

Hydrocarbons: v(g,s) = exp(A0 + s(A1 + s(A2 + s(A3 + s(A4 + s(A5))))))

Carbon Monoxide: v(g,s) = exp(A0 + s(A1 + s(A2 + s(A3 + s(A4 + s(A5))))))

Nitrogen Oxides: v(g,s) = (A0 + s(A1 + s(A2 + s(A3 + s(A4)))))

where:

A0,A1,A2,A3,A4, and A5 are coefficients listed in table below
g = Group Number; see Appendix A
exp = exponential function
v(g,s) = speed correction factor for group g at speed s

	A0	A1	A2	A3	A4	A5
GROUP 1						
HC=	2.2461E+00	-2.9097E-01	1.5889E-02	-4.7249E-04	6.9408E-06	-3.9280E-08
CO=	1.8198E+00	-2.5466E-01	1.5235E-02	-4.8740E-04	7.5821E-06	-4.4951E-08
NOx=	2.4442E+00	-2.5011E-01	1.3829E-02	-2.8703E-04	2.0758E-06	0.0000E+00
GROUP 2						
HC=	2.3103E+00	-2.8957E-01	1.5299E-02	-4.4669E-04	6.4818E-06	-3.6346E-08
CO=	2.3399E+00	-2.9698E-01	1.6007E-02	-4.7740E-04	7.0675E-06	-4.0398E-08
NOx=	1.6863E+00	-1.1830E-01	6.5497E-03	-1.3714E-04	1.0085E-06	0.0000E+00
GROUP 3						
HC=	2.1656E+00	-2.6999E-01	1.4420E-02	-4.3364E-04	6.5074E-06	-3.7810E-08
CO=	2.4415E+00	-2.9147E-01	1.4296E-02	-3.8785E-04	5.2978E-06	-2.8244E-08
NOx=	1.1265E+00	-3.9340E-02	2.6864E-03	-6.0802E-05	4.7729E-07	0.0000E+00
GROUP 4						
HC=	2.3973E+00	-2.9998E-01	1.6135E-02	-4.8749E-04	7.2909E-06	-4.1977E-08
CO=	2.4655E+00	-3.0502E-01	1.6050E-02	-4.7397E-04	6.9908E-06	-3.9976E-08
NOx=	1.2268E+00	-4.4498E-02	2.6248E-03	-5.6715E-05	4.3429E-07	0.0000E+00
GROUP 5						
HC=	2.4087E+00	-3.0819E-01	1.6817E-02	-5.0684E-04	7.5385E-06	-4.3160E-08
CO=	2.7780E+00	-3.1913E-01	1.5318E-02	-4.2233E-04	5.8495E-06	-3.1497E-08
NOx=	1.0174E+00	-1.1896E-02	9.1437E-04	-2.1574E-05	1.8230E-07	0.0000E+00
GROUP 6						
HC=	2.2322E+00	-2.8499E-01	1.5383E-02	-4.5674E-04	6.7349E-06	-3.8380E-08
CO=	2.7890E+00	-3.2711E-01	1.6294E-02	-4.6757E-04	6.7191E-06	-3.7440E-08
NOx=	9.8760E-01	-1.9567E-02	1.6964E-03	-4.0400E-05	3.2800E-07	0.0000E+00
GROUP 7						
HC=	2.2522E+00	-2.8778E-01	1.5682E-02	-4.7318E-04	7.0795E-06	-4.0846E-08
CO=	2.7074E+00	-3.3131E-01	1.7618E-02	-5.3858E-04	8.1740E-06	-4.7780E-08
NOx=	1.1592E+00	-4.4454E-02	2.9643E-03	-6.6899E-05	5.2236E-07	0.0000E+00
GROUP 8						
HC=	2.0278E+00	-2.7305E-01	1.5360E-02	-4.6030E-04	6.7853E-06	-3.8488E-08
CO=	1.8692E+00	-2.7660E-01	1.7233E-02	-5.5828E-04	8.7168E-06	-5.1698E-08
NOx=	1.8866E+00	-1.6129E-01	9.0499E-03	-1.8561E-04	1.3256E-06	0.0000E+00

```
              A0          A1          A2          A3          A4          A5
GROUP 9
 HC=   2.1506E+00 -2.8362E-01  1.5380E-02 -4.4214E-04  6.2873E-06 -3.4631E-08
 CO=   1.8213E+00 -2.7205E-01  1.7030E-02 -5.5202E-04  8.6254E-06 -5.1144E-08
NOx=   1.5578E+00 -1.1303E-01  6.7183E-03 -1.4341E-04  1.0608E-06  0.0000E+00

GROUP10
 HC=   2.2302E+00 -2.9365E-01  1.6240E-02 -4.8415E-04  7.1159E-06 -4.0286E-08
 CO=   2.0142E+00 -2.9519E-01  1.8635E-02 -6.2161E-04  9.9366E-06 -5.9978E-08
NOx=   2.0452E+00 -1.9401E-01  1.1074E-02 -2.3175E-04  1.6837E-06  0.0000E+00

GROUP11
 HC=   2.1223E+00 -2.9107E-01  1.6910E-02 -5.2615E-04  8.0271E-06 -4.7012E-08
 CO=   2.0453E+00 -3.1062E-01  2.0485E-02 -7.0853E-04  1.1621E-05 -7.1569E-08
NOx=   1.6326E+00 -1.2186E-01  7.0302E-03 -1.4629E-04  1.0614E-06  0.0000E+00

GROUP12
 HC=   2.1536E+00 -2.8345E-01  1.5700E-02 -4.6976E-04  6.9383E-06 -3.9471E-08
 CO=   2.3187E+00 -3.4115E-01  2.0945E-02 -6.6589E-04  1.0223E-05 -5.9827E-08
NOx=   1.4482E+00 -1.2244E-01  7.9502E-03 -1.7108E-04  1.2578E-06  0.0000E+00

GROUP13
 HC=   2.0735E+00 -2.8935E-01  1.7300E-02 -5.5471E-04  8.6420E-06 -5.1311E-08
 CO=   2.5752E+00 -3.2889E-01  1.8975E-02 -6.2826E-04  1.0092E-05 -6.1273E-08
NOx=   2.4597E-01  8.4195E-02 -3.4084E-03  6.2988E-05 -4.1397E-07  0.0000E+00

GROUP14
 HC=   2.3495E+00 -3.0496E-01  1.6842E-02 -5.0962E-04  7.5952E-06 -4.3496E-08
 CO=   2.6845E+00 -3.3282E-01  1.7628E-02 -5.2412E-04  7.7222E-06 -4.3702E-08
NOx=   1.2817E+00 -8.0487E-02  5.3574E-03 -1.1889E-04  9.0106E-07  0.0000E+00

GROUP15
 HC=   2.1134E+00 -2.8568E-01  1.6320E-02 -5.0079E-04  7.5507E-06 -4.3719E-08
 CO=   2.1549E+00 -3.2912E-01  2.1011E-02 -6.8906E-04  1.0839E-05 -6.4712E-08
NOx=   1.5345E+00 -1.2567E-01  7.8592E-03 -1.6943E-04  1.2549E-06  0.0000E+00

GROUP16
 HC=   2.1194E+00 -2.9863E-01  1.8450E-02 -6.1654E-04  9.9206E-06 -6.0402E-08
 CO=   2.5456E+00 -3.6285E-01  2.3277E-02 -8.1504E-04  1.3623E-05 -8.5591E-08
NOx=   7.0481E-01  3.8153E-02 -1.7391E-03  3.2614E-05 -2.0385E-07  0.0000E+00

GROUP17
 HC=   2.6838E+00 -3.4463E-01  1.9542E-02 -6.2572E-04  9.7844E-06 -5.8337E-08
 CO=   2.8393E+00 -3.6876E-01  2.1078E-02 -6.7644E-04  1.0627E-05 -6.3641E-08
NOx=   7.8384E-01  3.2855E-04  1.0603E-03 -3.1935E-05  2.9039E-07  0.0000E+00

GROUP18
 HC=   2.3954E+00 -3.3578E-01  2.1161E-02 -7.3155E-04  1.2072E-05 -7.4857E-08
 CO=   2.4875E+00 -3.9156E-01  2.7072E-02 -9.7618E-04  1.6527E-05 -1.0432E-07
NOx=   9.4213E-01 -4.2324E-02  3.8625E-03 -9.3985E-05  7.5388E-07  0.0000E+00
```

APPENDIX C

Sample Calculation of Motor Vehicle Emissions

Sample Calculation of Motor Vehicle Emissions

Calculation of Regional Hydrocarbon Emissions from Motor Vehicles

I. Introduction

This appendix to the revised motor vehicle emission factor document presents one procedure for calculating regionwide pollutant emissions in a step-by-step manner. Although most users of motor vehicle emission factors should rely on computerized calculations, this sample calculation may prove useful to those who are becoming familiarized with the methodologies presented in this document.

For this sample calculation we calculate light-duty vehicle hydrocarbon emissions for a July day in 1980. We assume an ambient temperature of 80° F. Although this HC calculation is not complete, it is designed to give the user an understanding of the logical sequence of calculations.

An inventory of motor vehicle sources of hydrocarbon emissions should include emissions from the four principal vehicle categories: light-duty vehicles(automobiles); light-duty trucks; heavy-duty gasoline-powered vehicles; and heavy-duty diesel-powered vehicles. For each vehicle category the composite exhaust emission factor equation presented in the corresponding chapter should be solved. The resultant composite emission factors, multiplied by the vehicles miles of travel (VMT) for the respective vehicle categories, yield the hydrocarbon exhaust emissions from the vehicle groups. For total hydrocarbon emission estimates, the crankcase and evaporative HC emissions must also be calculated and added to the exhaust HC emissions estimates.

II. Data Requirements

Before determining what data are required, the user should review the FTP conditions under which vehicles are tested in order to ascertain whether these conditions differ from the area-specific ambient temperature, average speeds, and vehicle operating modes. (See Introductions to Chapters I, II, III, and IV).

The user should determine the following area-specific data:

1. Ambient temperature.
2. Age-specific percent of annual travel for each vehicle category.
3. The VMT or vehicle counts and link lengths by various transient speed categories (e.g., by 10 mph increments).
4. Percent of VMT in cold start and hot start modes for light-duty vehicles and light-duty trucks.
5. Any other data required to utilize additional, optional correction factors. (For this sample calculation, all other factors are assumed to match FTP conditions.)

III. Data Used to Calculate Regionwide HC Emissions

For this sample calculation, the following conditions are applicable:

1. Ambient temperature is 80° F.
2. National statistics on average annual mileage and vehicle registration by model year will be used.
3. The hydrocarbon emissions will be calculated for only one speed category (30 mph). In actuality, emissions should be calculated for selected speed categories, each speed category having an associated trip length. From transportation data from our hypothetical region, the average trip length for a speed of 30 mph is 6 miles.
4. The percentages of VMT in the cold, stable, and hot transient modes are assumed to be 40%, 30%, and 30%, respectively, for light-duty vehicles, both catalyst and non-catalyst.

IV. Calculation of Composite Exhaust Emission Factor

The calculation of the composite exhaust hydrocarbon emission factor for light-duty vehicles, as discussed in Chapter I, is given by:

$$Enpstwx = CipnMinRipstwxAipLpUipw$$

Since the correction factors for air-conditioning usage (Aip), vehicle loading (Lp), and trailer towing (Uipw) are assumed to be equivalent to the FTP conditions, they are set equal to 1.0 (i.e., they have no effect on the calculations and may be disregarded).

Only three factors are of concern in this sample calculation: (1) the FTP mean emission factor (Cipn); (2) the fraction of annual travel (Min); and (3) the correction factor for speed, temperature, and vehicle operating modes (Ripstwx). Refer to Chapter I for a full explanation of the composite emission factor equation.

Step 1. Cipn -- FTP Emission Factor

The FTP mean emission factors for light-duty vehicles are the emission rates per unit mile assuming FTP conditions. These values are given in Table I-2 for hydrocarbons.

These Cipn values can be listed as shown in the following table, which will be used to calculate the composite exhaust emission factor.

The following steps, and subsequent completion of the table, will adjust the FTP mean emission factors for non-FTP conditions.

Table C-1

Calculation of Composite Exhaust Hydrocarbon Emission Factor for Light-Duty Vehicles

Calendar Year 1980
Ambient Temperature 80° F   Avg. Route Speed 30 mph
40% Cold Start/30% Hot Start

Model Year	Age	C_{ipn}	M_{in}	R_{ipstwx}	$(C_{ipn})(M_{in})(R_{ipstwx})$
1980	1	0.27			
1979	2	1.58			
1978	3	1.92			
1977	4	2.24			
1976	5	2.53			
1975	6	2.81			
1974	7	6.88			
1973	8	7.42			
1972	9	7.90			
1971	10	8.34			
1970	11	8.73			
1969	12	9.09			
1968	13	9.43			
1967	14	12.47			
1966	15	12.81			
1965	16	13.12			
1964	17	13.41			
1963	18	13.70			
1962	19	13.97			
1961	20	14.22			

Step 2. Min -- Fraction of Annual Travel

In order to calculate the fraction of annual travel by model year (Min), the fraction of in-use vehicles by model year (vehicle age) are weighted on the basis of annual rate of mileage accumulation. In many cases, area-specific data on automobile use and registration is readily available. Whenever possible, local data should be used. However, for purposes of this sample calculation, the nationwide average fraction of annual travel data from Table I-5 will be used.

The Min values are listed on the table to be used for calculating the composite exhaust emission factor.

Table C-2

Calculation of Composite Exhaust Hydrocarbon Emission Factor for Light-Duty Vehicles

Calendar Year 1980
Ambient Temperature 80° F   Avg. Route Speed 30 mph
40% Cold Start/30% Hot Start

Model Year	Age	Cipn	Min	Ripstwx	(Cipn)(Min)(Ripstwx)
1980	1	0.27	0.106		
1979	2	1.58	0.142		
1978	3	1.92	0.133		
1977	4	2.24	0.123		
1976	5	2.53	0.108		
1975	6	2.81	0.092		
1974	7	6.88	0.077		
1973	8	7.42	0.064		
1972	9	7.90	0.050		
1971	10	8.34	0.035		
1970	11	8.73	0.023		
1969	12	9.09	0.016		
1968	13	9.43	0.010		
1967	14	12.47	0.007		
1966	15	12.81	0.004		
1965	16	13.12	0.003		
1964	17	13.41	0.002		
1963	18	13.70	0.002		
1962	19	13.97	0.002		
1961	20	14.22	0.002		

Step 3. Ripstwx -- Correction Factor for Speed, Temperature, and Hot/Cold Mix.

Although the correction factor for speed, temperature, and hot/cold operating mode mix can be calculated manually using the generalized equations in Chapter I (Table I-6), the computer program available from EPA was used to generate the Ripstwx values for a cold/stable/hot mix of 40%/30%/30%, an ambient temperature of 80° F, and an average route speed of 30 mph.

The appropriate Ripstwx values are listed in the following table:

Table C-3

Calculation of Composite Exhaust Hydrocarbon Emission Factor for Light-Duty Vehicles

Calendar Year 1980
Ambient Temperature 80° F   Avg. Route Speed 30 mph
40% Cold Start/30% Hot Start

Model Year	Age	Cipn	Min	Bipstwx	(Cipn)(Min)(Bipstwx)
1980	1	0.27	0.106	1.087	
1979	2	1.58	0.142	0.907	
1978	3	1.92	0.133	0.889	
1977	4	2.24	0.123	0.877	
1976	5	2.53	0.108	0.869	
1975	6	2.81	0.092	0.863	
1974	7	6.88	0.077	0.834	
1973	8	7.42	0.064	0.835	
1972	9	7.90	0.050	0.881	
1971	10	8.34	0.035	0.883	
1970	11	8.73	0.023	0.890	
1969	12	9.09	0.016	0.875	
1968	13	9.43	0.010	0.867	
1967	14	12.47	0.007	0.841	
1966	15	12.81	0.004	0.841	
1965	16	13.12	0.003	0.841	
1964	17	13.41	0.002	0.842	
1963	18	13.70	0.002	0.842	
1962	19	13.97	0.002	0.842	
1961	20	14.22	0.002	0.842	

Step 4. Enpstwx -- Composite Exhaust Emission Factor

The final step in the calculation of the composite exhaust emission factor for light-duty vehicles is to multiply the mean emission factors and correction factors for each model year and then sum the products.

This procedure is shown in the completed table depicting the calculation of a composite exhaust emission factor for light-duty vehicles. The emission factor is expressed in units of grams per vehicle mile traveled.

Table C-4

Calculation of Composite Exhaust Hydrocarbon Emission Factor for Light-Duty Vehicles

Calendar Year 1980
Ambient Temperature 80° F   Avg. Route Speed 30 mph
40% Cold Start/30% Hot Start

Model Year	Age	Cipn	Min	Ripstwx	(Cipn)(Min)(Ripstwx)
1980	1	0.27	0.106	1.087	0.031
1979	2	1.58	0.142	0.907	0.204
1978	3	1.92	0.133	0.889	0.226
1977	4	2.24	0.123	0.877	0.241
1976	5	2.53	0.108	0.869	0.238
1975	6	2.81	0.092	0.863	0.223
1974	7	6.88	0.077	0.834	0.445
1973	8	7.42	0.064	0.835	0.397
1972	9	7.90	0.050	0.881	0.346
1971	10	8.34	0.035	0.883	0.258
1970	11	8.73	0.023	0.890	0.180
1969	12	9.09	0.016	0.875	0.125
1968	13	9.43	0.010	0.867	0.081
1967	14	12.47	0.007	0.841	0.077
1966	15	12.81	0.004	0.841	0.047
1965	16	13.12	0.003	0.841	0.030
1964	17	13.41	0.002	0.842	0.025
1963	18	13.70	0.002	0.842	0.024
1962	19	13.97	0.002	0.842	0.023
1961	20	14.22	0.002	0.842	0.019

Enpstwx = 3.237 gm/mi

Table C-5

Calculation of Evaporative
Hydrocarbon Emission Factor for Light-Duty Vehicles

Calendar Year 1980

Model Year	Age	Mi	Min	(Mi)(Mi)
1980	1	0.150	0.106	0.016
1979	2	0.600	0.142	0.085
1978	3	0.600	0.133	0.080
1977	4	1.760	0.123	0.216
1976	5	1.760	0.108	0.190
1975	6	1.760	0.092	0.162
1974	7	1.760	0.077	0.136
1973	8	1.760	0.064	0.113
1972	9	1.760	0.050	0.087
1971	10	1.760	0.035	0.062
1970	11	2.530	0.023	0.058
1969	12	2.530	0.016	0.040
1968	13	2.530	0.010	0.025
1967	14	3.330	0.007	0.024
1966	15	3.330	0.004	0.015
1965	16	3.330	0.003	0.009
1964	17	3.330	0.002	0.007
1963	18	3.330	0.002	0.007
1962	19	6.630	0.002	0.013
1961	20	6.630	0.002	0.010

Evaporative HC Emission Factor = 1.356 gm/mi

V. Calculate Regional HC Emissions from LDVs

(On the preceding pages a composite emission factor was calculated only for a speed of 30 mph. Composite emission factors for additional speed categories should be calculated, multiplied by VMT at each speed, and then summed to represent regional emissions.)

Now that a composite exhaust emission factor has been calculated (in grams/mile), we can determine the actual hydrocarbon emissions for the time period of concern as follows:

Step 1. Determine the total regional vehicle miles of travel (VMT is computed by multiplying the traffic volume on a given road segment by the length of that segment), the appropriate percent of total VMT represented by light-duty vehicle travel during the July day, and the light-duty VMT for each speed category. These categories could be by 10 mph increments between 5 mph and 55 mph in different portions of the urban area (e.g., CBD, 10 mile ring, the rest of the area).

Step 2. The daily total hydrocarbon emissions for each speed category equal the sum of the composite exhaust emission factor (calculated for this example to be 3.237 gm/mile for 30 mph) and the composite evaporative HC emission factor (calculated to be 1.356 gm/mi in Table C-5), multiplied by the daily VMT for that speed category for light-duty vehicles. LDV evaporative emissions are calculated using the

HC emission rates in Table I-8. The table following this section illustrates the procedure for computing the evaporative HC emission factor.

Step 3. The hydrocarbon emissions computed in Step 2 may be adjusted downward, as appropriate, if a motor vehicle inspection and maintenance program is in effect for the region. Appendix N to 40 CFR Part 51, as revised May 2, 1977, 42 Federal Register 22177, presents the procedures and factors to be used in calculating emission reduction credit from I/M programs.

VI. Calculate Regional HC Emissions from Other Vehicle Categories

Repeat the procedures given in Sections IV and V above to calculate the regional hydrocarbon emissions from all other vehicle categories (light-duty trucks; heavy-duty gasoline-powered vehicles; and heavy-duty diesel-powered vehicles), using the appropriate tables and equations in Chapters II, III, and IV.

Note that the composite emission factor equation for heavy-duty vehicles differs from the light-duty vehicle equation.

VII. Total Regional HC Emissions from Motor Vehicles.

The total regional hydrocarbon emissions are determined by simply adding the HC emissions from each vehicle category.

APPENDIX D

Motor Vehicle Emission Standards

APPENDIX D

VEHICLE EXHAUST EMISSION STANDARDS

Part One: Low-altitude, non-California Emission Standards

1. Light-duty Vehicles

Model Year	Hydrocarbons	Carbon Monoxide	Oxides of Nitrogen
Pre-1968	no standard	no standard	no standard
1968-1969	*410 ppm	*2.3% mole volume	no std.
	*350 ppm	*2.0%	no std.
	*275 ppm	*1.5%	no std.
1970- 71	1/ 2.2 gm/mi.	23 gm/mi.	no std.
1972	2/ 3.4 gm/mi.	39 gm/mi.	no std.
1973- 74	3.4 gm/mi.	39 gm/mi.	3 gm/mi.
1975- 76	3/ 1.5 gm/mi.	15 gm/mi.	3 gm/mi.
1977- 79	1.5 gm/mi.	15 gm/mi.	2.0 gm/mi.
1980	0.41 gm/mi.	7.0 gm/mi.	2.0 gm/mi.
1981+	0.41 gm/mi.	3.4 gm/mi.	1.0 gm/mi.

*Emission standard varied with vehicle's cubic inch displacement; using 7-mode driving cycle test

1/ Using 7-mode test

2/ Using 1972 FTP (constant volume sampler)

3/ Using 1975 FTP (CVS)

2. Light-duty Trucks

a. LDT's less than 6000 pounds (gm/mi):

Model Year	HC	CO	NOx
Pre-1975	Same standards as LDV's (automobiles)		
1975-1978	2.0	20	3.1
1979- 82	1.7	17.9	2.3
*1983- 84	0.99	9.4	2.3
*1985+	0.99	9.4	1.4

b. LDT's between 6001 and 8500 pounds (gm/mi):

Model Year	HC	CO	NOx
Pre-1979	Same standards as Heavy-duty Gas Vehicles		
1979- 82	1.7	17.9	2.3
*1983- 84	0.99	9.4	2.3
*1985+	0.99	9.4	1.4

*Predicted standards

3. Heavy-duty Gasoline Vehicles

Model Year	Standards
Pre-1970	no standard
1970-1973	CO = 1.5% mole volume
	HC = 275 ppm
	NOx = no standard
1974-1978	1/ CO = 40 grams per brake-horsepower-hour
	2/ HC plus NOx = 16 grams per bhp.-hr.
1979-1982	3/ CO = 25 gm/bhp.-hr.
	4/ HC = 1.5 gm/bhp.-hr.
	5/ HC + NOx = 10 gm/bhp.-hr.
1983- 84	*CO =29.7 gm/mi.
	*HC = 2.85 gm/mi.
1985+	*NOx = 5.35 gm/mi.

1/ g/mi. equivalent standard is 159 gm/mi. CO

2/ g/mi. equivalent standard is 12.4 g/mi. HC and 15.3 g/mi. NOx

3/ " " " " 140 g/mi. CO

4/ " " " " 3.2 g/mi. HC

5/ " " " " 13.3 g/mi. NOx

*Predicted standard

4. Heavy-duty Diesel Vehicles

Model Year	CO	HC plus NOx
Pre-1973	no std.	no std.
1973	1.5%	no std.
1974- 78	40 g/bhp-hr.	16 g/bhp-hr.
1979- 82	25 g/bhp-hr.	1.5g HC and 10g NOx or: 5g HC plus NOx
*1983+	Same as gasoline HDV's	

5. Motorcycles

Model Year	HC	CO	NOx
Pre-1978	no std.	no std.	no. std.
1980- 82	5-14 g/km	17 g/km	no std.
1980-	5 g/km	12 g/km	no std.
*1983	0.97 g/km	12 g/km	no std.
*1985	0.97 g/km	12 g/km	0.14 g/km

*Predicted standards

APPENDIX F

National Average Emission Factors for Highway Vehicles

APPENDIX F

National Average Emission Factors for Highway Vehicles

Passenger cars, light trucks, heavy trucks, and motorcycles comprise the four main categories of highway vehicles. Within each of these categories, engine and fuel variations result in significantly different emission characteristics. For example, heavy trucks may be powered by gasoline or diesel fuel or operate on a gaseous fuel such as compressed natural gas.

It is important to note that highway vehicle emission factors change with time and, therefore, must be calculated for a specific time period. The major reason for this time dependence is the gradual replacement of vehicles without emission control equipment by vehicles with control equipment, as well as the gradual deterioration of vehicles with control equipment as they accumulate age and mileage.

This appendix contains average emission factors for calendar years 1970 through 1999 for selected values of: vehicle miles traveled by vehicle type (passenger cars, light trucks, heavy trucks, and motorcycles), ambient temperature, cold/hot weighting, and average route speed. This appendix includes one case that represents the average national emission factors, as generated in the Federal Test Procedure (Table F-3), as well as twenty other scenarios that can be used to assess the sensitivity of the composite emission factors to changing input conditions. All emission factors are given in units of grams of pollutant per mile traveled.

The emission factors given in preceding chapters are for individual classes of highway vehicles, and their application is encouraged if specific statistical data are available for the areas under study. The statistical data required include vehicle registration by model year and vehicle type, annual vehicle mileage accumulation by vehicle type and age, average ambient temperature, percentage of cold engine operation by vehicle type, average route speed, and other input data, if available, to determine additional correction factors. When area-specific inputs are not available, national values (which are discussed in this appendix) may be applied.

Emission factors presented in this section are intended to assist those individuals interested in compiling approximate mobile source emission estimates for large areas, such as an individual air quality region or the entire nation.

The emission factor calculation techniques presented in the previous chapters are strongly recommended for the formulation of localized emission estimates required for air quality modeling or for the evaluation of air pollutant control strategies. Many factors, which vary with geographic location and estimation situation, can affect emission estimates considerably. The factors of concern include average vehicle speed, percentage of cold vehicle operation, percentage of travel by vehicle category (as listed above), ambient temperature, air conditioning usage, vehicle load, trailer towing, and humidity. Clearly, the infinite number of variations in these factors make it impossible to present composite mobile source emission factors for each application. An effort has been made, therefore, to present average emission factors for a range of conditions. The following conditions are considered for each of these cases:

Average vehicle speed. Two vehicle speeds are considered. The first is an average speed of 19.6 mi/hr, which should be typical of a large percentage of urban vehicle operation. The second is an average speed of 45 mi/hr, which should be typical of highway or rural operation.

Percentage of cold operation. Three percentages of cold operation are considered. The first (at 19.6 mi/hr) assumes that 20% of the automobiles and light trucks are operating in a cold condition (representative of vehicle start-up after a long engine-off period) and that 80% of the automobiles and light trucks are operating in a stabilized condition (warmed-up vehicle operation), with 27% having started hot. This condition can be expected to assess the engine temperature situation over a large area for an entire day. The second situation assumes that 100% of the automobiles and light trucks are operating in a stabilized condition (45 mi/hr). This might be applicable to rural or highway operation. The third situation (at 19.6 mi/hr) assumes that 100% of the automobiles and light trucks are operating in a cold condition. This might be a worst-case situation around an indirect source such as a sports stadium after an event lets out. In all three situations, heavy-duty vehicles are assumed to be operating in a hot stabilized condition.

Percentage of travel by vehicle type. Three situations are considered. The first (at both 19.6 mi/hr and 45 mi/hr) involves a nationwide mix of vehicle miles traveled by automobiles, light trucks, heavy gasoline trucks, heavy diesel trucks, and motorcycles. The specific percentages are 80.3%, 11.6%, 4.5%, 3.1%, and 0.5% of total vehicle miles traveled, respectively. The second (at 19.6 mi/hr) examines a mix of vehicle miles traveled that might be found in a central city area. The specific percentages are 63%, 32%, 2.5%, 2.5%, and 0.0% respectively. The third (at 19.6 mi/hr) examines a mix of vehicles that might be found in a suburban location or near a localized indirect source where no heavy truck operation exists. The specific percentages 88.2%, 11.8%, 0.0%, 0.0%, and 0.0%, respectively.

Ambient temperature. Three situations are considered for each scenario: an average ambient temperature of 75°F, 50°F, or 25°F.

Each table presents composite CO, HC, and NOx factors for one of the 21 cases discussed above for calendar years 1970-1999. The table entries were calculated using the techniques described and data presented in the chapters which preceded this appendix. Examination of the tables can indicate the sensitivity of the composite emission factor to various conditions. A user who has specific data on the input factors should calculate a composite factor to fit the exact scenario. When specific input factor data are not available, however, it is hoped that the range of values presented in the tables will cover the majority of applications. The user should be sure, however, that the appropriate scenario is chosen to fit the situation under analysis. In some cases, it is not necessary to apply the various correction factors because the basic emission factors (75°F, 19.6 mi/hr, 20% cold operation, nationwide mix of travel by vehicle category, etc.) are reasonably accurate predictors of motor vehicle emissions on a regionwide (urban) basis.

Tabled Scenarios for Average Highway Vehicle Emission Factors

Table	Temp(°F)	Speed(mph)	%Cold Start	%Hot Start	Veh. Mix
F-1	25°	19.6	20.6	27.3	1*
F-2	50°	19.6	20.6	27.3	1*
F-3	75°	19.6	20.6	27.3	1*
F-4	25°	19.6	100.0	0.0	1*
F-5	50°	19.6	100.0	0.0	1*
F-6	75°	19.6	100.0	0.0	1*
F-7	25°	19.6	20.6	27.3	2*
F-8	50°	19.6	20.6	27.3	2*
F-9	75°	19.6	20.6	27.3	2*
F-10	25°	19.6	100.0	0.0	2*
F-11	50°	19.6	100.0	0.0	2*
F-12	75°	19.6	100.0	0.0	2*
F-13	25°	19.6	20.6	27.3	3*
F-14	50°	19.6	20.6	27.3	3*
F-15	75°	19.6	20.6	27.3	3*
F-16	25°	19.6	100.0	0.0	3*
F-17	50°	19.6	100.0	0.0	3*
F-18	75°	19.6	100.0	0.0	3*
F-19	25°	45.0	0.0	0.0	1*
F-20	50°	45.0	0.0	0.0	1*
F-21	75°	45.0	0.0	0.0	1*

*1 represents 80.3% autos, 5.8% for each of the two light truck classes, 4.5% heavy gas trucks, 3.5% heavy duty diesels, and 0.50 motorcycle VMT.

*2 represents 63% autos, 16% for each of the two light truck classes, 2.5% heavy gas trucks, and 2.5% heavy duty diesel vehicle VMT.

*3 represents 88.2% autos, and 5.9% for each of the two light truck classes.

TABLE F- 1

SPEED: 19.6 M.P.H.   TEMP: 25. (F)   % COLD START: 20.6%
MS: 0.803 0.058 0.058 0.045 0.031 0.005   % HOT START: 27.3%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	13.6	107.7	4.7
1971	12.9	104.5	4.8
1972	12.3	102.3	4.9
1973	11.7	100.7	4.8
1974	11.3	99.8	4.7
1975	10.8	97.6	4.5
1976	10.2	94.6	4.4
1977	9.6	91.5	4.1
1978	9.0	88.2	3.9
1979	8.4	84.7	3.8
1980	7.5	78.6	3.6
1981	6.7	71.4	3.4
1982	5.9	64.7	3.2
1983	5.3	57.9	3.0
1984	4.7	51.3	2.9
1985	4.2	45.6	2.7
1986	3.9	40.7	2.5
1987	3.6	36.7	2.4
1988	3.4	33.4	2.2
1989	3.2	30.8	2.1
1990	3.1	28.9	2.1
1991	3.0	27.5	2.0
1992	3.0	26.4	2.0
1993	2.9	25.6	2.0
1994	2.9	25.0	1.9
1995	2.9	24.6	1.9
1996	2.9	24.6	1.9
1997	2.9	24.6	1.9
1998	2.9	24.6	1.9
1999	2.9	24.6	1.9

TABLE F- 2

SPEED: 19.6 M.P.H.   TEMP: 50. (F)   % COLD START: 20.6%
MS: 0.803 0.058 0.058 0.045 0.031 0.005   % HOT START: 27.3%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	12.7	95.2	4.7
1971	12.0	92.2	4.8
1972	11.4	89.9	4.9
1973	10.9	88.4	4.8
1974	10.5	87.4	4.7
1975	10.0	85.2	4.5
1976	9.4	82.2	4.4
1977	8.9	79.0	4.1
1978	8.3	75.7	3.9
1979	7.7	72.2	3.8
1980	6.9	67.0	3.6
1981	6.1	61.1	3.4
1982	5.4	55.6	3.2
1983	4.8	50.0	3.0
1984	4.3	44.5	2.9
1985	3.9	39.8	2.7
1986	3.5	35.7	2.5
1987	3.3	32.4	2.4
1988	3.1	29.7	2.2
1989	2.9	27.5	2.1
1990	2.8	25.9	2.1
1991	2.8	24.7	2.0
1992	2.7	23.8	2.0
1993	2.6	23.0	2.0
1994	2.6	22.5	1.9
1995	2.6	22.1	1.9
1996	2.6	22.1	1.9
1997	2.6	22.1	1.9
1998	2.6	22.1	1.9
1999	2.6	22.1	1.9

TABLE F- 3

SPEED: 19.6 M.P.H.   TEMP: 75. (F)   % COLD START: 20.6%
MS: 0.803 0.058 0.058 0.045 0.031 0.005   % HOT START: 27.3%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	12.1	86.9	4.7
1971	11.4	83.9	4.8
1972	10.8	81.6	4.9
1973	10.3	80.0	4.8
1974	9.9	79.0	4.7
1975	9.4	77.0	4.5
1976	8.9	74.3	4.4
1977	8.5	71.4	4.1
1978	7.9	68.3	3.9
1979	7.3	65.2	3.8
1980	6.6	60.6	3.6
1981	5.8	55.5	3.4
1982	5.1	50.6	3.2
1983	4.6	45.7	3.0
1984	4.1	40.9	2.9
1985	3.6	36.7	2.7
1986	3.3	33.0	2.5
1987	3.1	30.0	2.4
1988	2.9	27.6	2.2
1989	2.7	25.6	2.1
1990	2.7	24.2	2.1
1991	2.6	23.1	2.0
1992	2.5	22.2	2.0
1993	2.5	21.5	2.0
1994	2.4	21.1	1.9
1995	2.4	20.7	1.9
1996	2.4	20.7	1.9
1997	2.4	20.7	1.9
1998	2.4	20.7	1.9
1999	2.4	20.7	1.9

TABLE F- 4

SPEED: 19.6 M.P.H. TEMP: 25. (F) % COLD START: 100.0%
MS: 0.803 0.058 0.058 0.045 0.031 0.005 % HOT START: 0.0%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	22.6	228.7	5.0
1971	21.8	224.7	5.1
1972	21.0	222.7	5.2
1973	20.4	221.9	5.2
1974	19.9	222.1	5.1
1975	19.0	219.3	4.9
1976	18.1	214.7	4.8
1977	17.2	209.6	4.6
1978	16.2	204.0	4.4
1979	15.1	198.0	4.3
1980	13.6	183.2	4.1
1981	12.2	165.3	3.9
1982	10.9	148.6	3.7
1983	9.8	132.5	3.6
1984	8.9	117.6	3.4
1985	8.1	104.9	3.3
1986	7.5	93.9	3.1
1987	7.1	85.2	2.9
1988	6.8	78.1	2.7
1989	6.5	72.5	2.6
1990	6.4	68.6	2.6
1991	6.2	65.7	2.5
1992	6.1	63.5	2.5
1993	6.1	61.9	2.5
1994	6.0	60.8	2.4
1995	5.9	59.9	2.4
1996	5.9	59.9	2.4
1997	5.9	59.9	2.4
1998	5.9	59.9	2.4
1999	5.9	59.9	2.4

```
                                     TABLE F- 5

SPEED:  19.6 M.P.H.             TEMP:  50. (F)              % COLD START: 100.0%
   MS:  0.803 0.058 0.058 0.045 0.031 0.005                  % HOT START:    0.0%

                      AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

                        CY          HC          CO          NOX

                       1970        18.3       168.1         5.0
                       1971        17.5       164.7         5.1
                       1972        16.9       162.7         5.2
                       1973        16.3       161.7         5.2
                       1974        15.8       161.5         5.1
                       1975        15.2       158.7         4.9
                       1976        14.4       154.1         4.8
                       1977        13.6       149.0         4.6
                       1978        12.8       143.3         4.4
                       1979        11.9       137.4         4.3
                       1980        10.7       127.1         4.1
                       1981         9.5       115.3         3.9
                       1982         8.5       104.5         3.7
                       1983         7.6        94.1         3.6
                       1984         6.9        84.6         3.4
                       1985         6.3        76.6         3.3
                       1986         5.8        69.8         3.1
                       1987         5.5        64.5         2.9
                       1988         5.2        60.0         2.7
                       1989         5.0        56.5         2.6
                       1990         4.9        54.0         2.6
                       1991         4.8        52.1         2.5
                       1992         4.7        50.6         2.5
                       1993         4.7        49.4         2.5
                       1994         4.6        48.6         2.4
                       1995         4.6        48.0         2.4
                       1996         4.6        48.0         2.4
                       1997         4.6        48.0         2.4
                       1998         4.6        48.0         2.4
                       1999         4.6        48.0         2.4
```

TABLE F- 6

SPEED: 19.6 M.P.H. TEMP: 75. (F) % COLD START: 100.0%
MX: 0.803 0.058 0.058 0.045 0.031 0.005 % HOT START: 0.0%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	15.3	127.5	5.0
1971	14.6	124.4	5.1
1972	14.0	122.5	5.2
1973	13.4	121.3	5.2
1974	13.0	120.9	5.1
1975	12.5	119.1	4.9
1976	11.9	116.0	4.8
1977	11.3	112.1	4.6
1978	10.7	107.8	4.4
1979	9.9	103.0	4.3
1980	8.9	95.8	4.1
1981	7.9	87.9	3.9
1982	7.1	80.5	3.7
1983	6.3	73.3	3.6
1984	5.7	66.8	3.4
1985	5.2	61.2	3.3
1986	4.8	56.6	3.1
1987	4.5	52.9	2.9
1988	4.3	49.8	2.7
1989	4.2	47.4	2.6
1990	4.1	45.6	2.6
1991	4.0	44.2	2.5
1992	3.9	43.0	2.5
1993	3.9	42.1	2.5
1994	3.8	41.5	2.4
1995	3.8	41.0	2.4
1996	3.8	41.0	2.4
1997	3.8	41.0	2.4
1998	3.8	41.0	2.4
1999	3.8	41.0	2.4

TABLE F- 7

SPEED: 19.6 M.P.H.   TEMP: 25. (F)   % COLD START: 20.6%
MS: 0.630 0.160 0.160 0.025 0.025 0.0   % HOT START: 27.3%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	13.8	108.0	4.7
1971	13.1	104.4	4.8
1972	12.5	101.8	4.9
1973	11.9	100.0	4.8
1974	11.4	98.9	4.7
1975	10.9	96.6	4.5
1976	10.3	93.8	4.3
1977	9.8	90.9	4.1
1978	9.2	88.0	3.9
1979	8.6	84.8	3.7
1980	7.8	79.5	3.6
1981	7.0	73.5	3.3
1982	6.3	67.9	3.1
1983	5.7	61.9	3.0
1984	5.1	55.9	2.8
1985	4.6	50.4	2.7
1986	4.2	45.3	2.5
1987	3.9	41.1	2.3
1988	3.6	37.5	2.2
1989	3.4	34.5	2.1
1990	3.3	32.2	2.0
1991	3.1	30.4	1.9
1992	3.1	28.9	1.9
1993	3.0	27.8	1.9
1994	2.9	27.0	1.9
1995	2.9	26.2	1.9
1996	2.9	26.2	1.9
1997	2.9	26.2	1.9
1998	2.9	26.2	1.9
1999	2.9	26.2	1.9

TABLE F- 8

SPEED: 19.6 M.P.H.   TEMP: 50. (F)   % COLD START: 20.6%
MS: 0.630 0.160 0.160 0.025 0.025 0.0   % HOT START: 27.3%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	12.9	94.6	4.7
1971	12.2	91.2	4.8
1972	11.6	88.8	4.9
1973	11.0	87.0	4.8
1974	10.6	85.8	4.7
1975	10.0	83.6	4.5
1976	9.5	80.8	4.3
1977	9.0	77.9	4.1
1978	8.4	74.9	3.9
1979	7.8	71.8	3.7
1980	7.1	67.2	3.6
1981	6.4	62.1	3.3
1982	5.7	57.3	3.1
1983	5.1	52.4	3.0
1984	4.6	47.4	2.8
1985	4.2	42.9	2.7
1986	3.8	38.7	2.5
1987	3.5	35.3	2.3
1988	3.2	32.4	2.2
1989	3.1	29.8	2.1
1990	2.9	27.9	2.0
1991	2.8	26.3	1.9
1992	2.7	25.1	1.9
1993	2.7	24.1	1.9
1994	2.6	23.4	1.9
1995	2.5	22.7	1.9
1996	2.5	22.7	1.9
1997	2.5	22.7	1.9
1998	2.5	22.7	1.9
1999	2.5	22.7	1.9

TABLE F- 9

SPEED: 19.6 M.P.H. TEMP: 75. (F) % COLD START: 20.6%
MS: 0.630 0.160 0.160 0.025 0.025 0.0 % HOT START: 27.3%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	12.2	85.6	4.7
1971	11.5	82.4	4.8
1972	10.9	80.0	4.9
1973	10.4	78.3	4.8
1974	10.0	77.1	4.7
1975	9.5	75.1	4.5
1976	9.0	72.5	4.3
1977	8.5	69.9	4.1
1978	8.0	67.1	3.9
1979	7.4	64.3	3.7
1980	6.7	60.2	3.6
1981	6.0	55.8	3.3
1982	5.4	51.6	3.1
1983	4.8	47.2	3.0
1984	4.3	42.9	2.8
1985	3.9	38.9	2.7
1986	3.5	35.2	2.5
1987	3.2	32.2	2.3
1988	3.0	29.5	2.2
1989	2.9	27.3	2.1
1990	2.7	25.6	2.0
1991	2.6	24.1	1.9
1992	2.5	23.0	1.9
1993	2.5	22.1	1.9
1994	2.4	21.4	1.9
1995	2.4	20.8	1.9
1996	2.4	20.8	1.9
1997	2.4	20.8	1.9
1998	2.4	20.8	1.9
1999	2.4	20.8	1.9

TABLE F-10

SPEED: 19.6 M.P.H. TEMP: 25. (F) % COLD START: 100.0%
MS: 0.630 0.160 0.160 0.025 0.025 0.0 % HOT START: 0.0%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	23.7	239.6	5.1
1971	22.7	233.9	5.2
1972	21.9	230.3	5.2
1973	21.2	228.3	5.2
1974	20.6	227.7	5.0
1975	19.7	224.5	4.9
1976	18.8	220.0	4.8
1977	17.9	215.4	4.6
1978	16.9	210.7	4.4
1979	15.9	205.2	4.3
1980	14.6	192.9	4.1
1981	13.2	178.3	3.9
1982	12.1	164.8	3.7
1983	11.0	150.6	3.6
1984	10.0	136.1	3.4
1985	9.2	123.1	3.3
1986	8.5	111.0	3.0
1987	7.9	101.3	2.9
1988	7.5	92.9	2.7
1989	7.1	85.9	2.6
1990	6.9	80.6	2.6
1991	6.7	76.4	2.5
1992	6.5	73.2	2.5
1993	6.4	70.8	2.4
1994	6.2	69.1	2.4
1995	6.2	67.4	2.4
1996	6.2	67.4	2.4
1997	6.2	67.4	2.4
1998	6.2	67.4	2.4
1999	6.2	67.4	2.4

TABLE F-11

SPEED: 19.6 M.P.H. TEMP: 50. (F) % COLD START: 100.0%
MS: 0.630 0.160 0.160 0.025 0.025 0.0 % HOT START: 0.0%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	19.0	174.3	5.1
1971	18.2	169.8	5.2
1972	17.5	166.9	5.2
1973	16.8	165.2	5.2
1974	16.3	164.4	5.0
1975	15.6	161.4	4.9
1976	14.9	157.0	4.8
1977	14.1	152.3	4.6
1978	13.3	147.3	4.4
1979	12.5	141.8	4.3
1980	11.4	132.8	4.1
1981	10.3	122.8	3.9
1982	9.3	113.6	3.7
1983	8.4	104.3	3.6
1984	7.7	95.0	3.4
1985	7.0	86.7	3.3
1986	6.4	79.2	3.0
1987	6.0	73.0	2.9
1988	5.7	67.7	2.7
1989	5.4	63.1	2.6
1990	5.2	59.6	2.6
1991	5.1	56.8	2.5
1992	4.9	54.6	2.5
1993	4.8	52.8	2.4
1994	4.7	51.5	2.4
1995	4.6	50.3	2.4
1996	4.6	50.3	2.4
1997	4.6	50.3	2.4
1998	4.6	50.3	2.4
1999	4.6	50.3	2.4

TABLE F-12

SPEED: 19.6 M.P.H. TEMP: 75. (F) % COLD START: 100.0%
MS: 0.630 0.160 0.160 0.025 0.025 0.0 % HOT START: 0.0%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	15.8	130.5	5.1
1971	15.1	126.9	5.2
1972	14.4	124.4	5.2
1973	13.8	122.8	5.2
1974	13.4	122.0	5.0
1975	12.8	120.0	4.9
1976	12.2	117.0	4.8
1977	11.6	113.5	4.6
1978	11.0	109.5	4.4
1979	10.3	105.2	4.3
1980	9.4	98.9	4.1
1981	8.4	92.0	3.9
1982	7.6	85.6	3.7
1983	6.9	79.2	3.6
1984	6.3	72.8	3.4
1985	5.7	67.2	3.3
1986	5.3	62.0	3.0
1987	4.9	57.8	2.9
1988	4.6	54.0	2.7
1989	4.4	50.7	2.6
1990	4.3	48.2	2.6
1991	4.1	46.1	2.5
1992	4.0	44.3	2.5
1993	3.9	43.0	2.4
1994	3.8	41.9	2.4
1995	3.8	41.0	2.4
1996	3.8	41.0	2.4
1997	3.8	41.0	2.4
1998	3.8	41.0	2.4
1999	3.8	41.0	2.4

TABLE F-13

SPEED: 19.6 M.P.H. TEMP: 25. (F) % COLD START: 20.6%
MS: 0.882 0.059 0.059 0.0 0.0 0.0 % HOT START: 27.3%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	12.8	100.8	3.9
1971	12.1	97.7	4.0
1972	11.5	95.5	4.1
1973	11.0	94.2	4.0
1974	10.6	93.4	3.9
1975	10.0	91.2	3.7
1976	9.4	88.0	3.5
1977	8.8	84.7	3.3
1978	8.2	81.1	3.1
1979	7.5	77.5	2.9
1980	6.7	71.0	2.7
1981	5.9	63.4	2.5
1982	5.2	56.1	2.3
1983	4.6	49.4	2.1
1984	4.0	43.4	2.0
1985	3.6	38.4	1.9
1986	3.3	34.0	1.8
1987	3.1	30.5	1.7
1988	2.9	27.6	1.7
1989	2.7	25.4	1.6
1990	2.6	23.8	1.6
1991	2.6	22.6	1.6
1992	2.5	21.7	1.6
1993	2.4	21.0	1.6
1994	2.4	20.5	1.6
1995	2.4	20.2	1.6
1996	2.4	20.2	1.6
1997	2.4	20.2	1.6
1998	2.4	20.2	1.6
1999	2.4	20.2	1.6

TABLE F-14

SPEED: 19.6 M.P.H. TEMP: 50. (F) % COLD START: 20.6%
MS: 0.882 0.059 0.059 0.0 0.0 0.0 % HOT START: 27.3%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	11.8	87.3	3.9
1971	11.2	84.3	4.0
1972	10.6	82.2	4.1
1973	10.1	80.7	4.0
1974	9.7	79.9	3.9
1975	9.1	77.7	3.7
1976	8.6	74.5	3.5
1977	8.0	71.1	3.3
1978	7.4	67.6	3.1
1979	6.8	64.0	2.9
1980	6.0	58.5	2.7
1981	5.3	52.3	2.5
1982	4.6	46.4	2.3
1983	4.1	40.9	2.1
1984	3.6	36.1	2.0
1985	3.2	32.1	1.9
1986	2.9	28.7	1.8
1987	2.7	25.9	1.7
1988	2.5	23.6	1.7
1989	2.4	21.8	1.6
1990	2.3	20.6	1.6
1991	2.2	19.6	1.6
1992	2.2	18.8	1.6
1993	2.1	18.2	1.6
1994	2.1	17.8	1.6
1995	2.1	17.5	1.6
1996	2.1	17.5	1.6
1997	2.1	17.5	1.6
1998	2.1	17.5	1.6
1999	2.1	17.5	1.6

TABLE F-15

SPEED: 19.6 M.P.H. TEMP: 75. (F) % COLD START: 20.6%
MS: 0.882 0.059 0.059 0.0 0.0 0.0 % HOT START: 27.3%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	11.2	78.3	3.9
1971	10.5	75.3	4.0
1972	9.9	73.2	4.1
1973	9.4	71.7	4.0
1974	9.0	70.8	3.9
1975	8.5	68.8	3.7
1976	8.0	66.0	3.5
1977	7.5	62.9	3.3
1978	6.9	59.6	3.1
1979	6.3	56.3	2.9
1980	5.6	51.5	2.7
1981	4.9	46.2	2.5
1982	4.3	41.0	2.3
1983	3.8	36.3	2.1
1984	3.3	32.2	2.0
1985	3.0	28.7	1.9
1986	2.7	25.8	1.8
1987	2.5	23.4	1.7
1988	2.3	21.4	1.7
1989	2.2	19.8	1.6
1990	2.1	18.7	1.6
1991	2.1	17.8	1.6
1992	2.0	17.2	1.6
1993	2.0	16.6	1.6
1994	1.9	16.3	1.6
1995	1.9	16.0	1.6
1996	1.9	16.0	1.6
1997	1.9	16.0	1.6
1998	1.9	16.0	1.6
1999	1.9	16.0	1.6

TABLE F-16

SPEED: 19.6 M.P.H. TEMP: 25. (F) % COLD START: 100.0%
MS: 0.882 0.059 0.059 0.0 0.0 0.0 % HOT START: 0.0%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	22.5	231.8	4.3
1971	21.7	227.8	4.4
1972	20.9	225.9	4.5
1973	20.3	225.4	4.4
1974	19.8	225.9	4.2
1975	18.9	223.1	4.1
1976	17.9	218.2	4.0
1977	16.9	212.7	3.8
1978	15.8	206.6	3.6
1979	14.7	200.2	3.4
1980	13.2	184.2	3.3
1981	11.8	164.8	3.1
1982	10.5	146.7	2.9
1983	9.4	129.8	2.7
1984	8.5	114.8	2.6
1985	7.8	102.2	2.5
1986	7.3	91.4	2.4
1987	6.8	82.8	2.3
1988	6.5	75.7	2.2
1989	6.3	70.4	2.2
1990	6.1	66.6	2.1
1991	6.0	63.8	2.1
1992	5.9	61.7	2.1
1993	5.8	60.2	2.1
1994	5.8	59.1	2.1
1995	5.7	58.3	2.1
1996	5.7	58.3	2.1
1997	5.7	58.3	2.1
1998	5.7	58.3	2.1
1999	5.7	58.3	2.1

TABLE F-17

SPEED: 19.6 M.P.H. TEMP: 50. (F) % COLD START: 100.0%
MS: 0.882 0.059 0.059 0.0 0.0 0.0 % HOT START: 0.0%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	17.8	166.2	4.3
1971	17.1	162.9	4.4
1972	16.4	161.0	4.5
1973	15.9	160.2	4.4
1974	15.4	160.3	4.2
1975	14.7	157.4	4.1
1976	13.9	152.5	4.0
1977	13.1	147.0	3.8
1978	12.2	140.8	3.6
1979	11.3	134.5	3.4
1980	10.1	123.4	3.3
1981	8.9	110.8	3.1
1982	7.9	99.1	2.9
1983	7.1	88.5	2.7
1984	6.4	79.4	2.6
1985	5.8	71.8	2.5
1986	5.4	65.5	2.4
1987	5.1	60.5	2.3
1988	4.9	56.4	2.2
1989	4.7	53.2	2.2
1990	4.6	51.0	2.1
1991	4.5	49.2	2.1
1992	4.4	47.9	2.1
1993	4.4	46.9	2.1
1994	4.3	46.1	2.1
1995	4.3	45.6	2.1
1996	4.3	45.6	2.1
1997	4.3	45.6	2.1
1998	4.3	45.6	2.1
1999	4.3	45.6	2.1

```
                              TABLE F-18

SPEED:  19.6 M.P.H.          TEMP:  75. (F)          % COLD START: 100.0%
   MS:  0.882 0.059 0.059 0.0   0.0   0.0             % HOT START:    0.0%

                AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

                CY           HC           CO           NOX

               1970         14.6        122.3          4.3
               1971         13.9        119.3          4.4
               1972         13.3        117.4          4.5
               1973         12.8        116.5          4.4
               1974         12.4        116.2          4.2
               1975         11.9        114.4          4.1
               1976         11.3        111.2          4.0
               1977         10.6        107.1          3.8
               1978          9.9        102.4          3.6
               1979          9.1         97.3          3.4
               1980          8.2         89.7          3.3
               1981          7.2         81.2          3.1
               1982          6.4         73.3          2.9
               1983          5.7         66.2          2.7
               1984          5.1         60.2          2.6
               1985          4.7         55.3          2.5
               1986          4.4         51.3          2.4
               1987          4.1         48.2          2.3
               1988          3.9         45.5          2.2
               1989          3.8         43.4          2.2
               1990          3.7         41.9          2.1
               1991          3.6         40.8          2.1
               1992          3.6         39.8          2.1
               1993          3.5         39.1          2.1
               1994          3.5         38.5          2.1
               1995          3.4         38.1          2.1
               1996          3.4         38.1          2.1
               1997          3.4         38.1          2.1
               1998          3.4         38.1          2.1
               1999          3.4         38.1          2.1
```

TABLE F-19

SPEED: 45.0 M.P.H. TEMP: 25. (F) % COLD START: 0.0%
MS: 0.803 0.058 0.058 0.045 0.031 0.005 % HOT START: 0.0%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	7.3	40.5	4.9
1971	6.8	37.9	5.0
1972	6.3	35.8	5.1
1973	5.9	33.9	5.1
1974	5.5	32.4	5.0
1975	5.2	30.8	4.9
1976	4.8	29.2	4.8
1977	4.5	27.8	4.6
1978	4.1	26.5	4.4
1979	3.7	25.4	4.3
1980	3.3	23.9	4.1
1981	2.8	22.2	3.9
1982	2.4	20.6	3.7
1983	2.0	18.8	3.5
1984	1.7	16.8	3.4
1985	1.5	15.0	3.2
1986	1.3	13.3	3.0
1987	1.1	12.0	2.8
1988	1.0	10.8	2.6
1989	0.9	9.9	2.5
1990	0.8	9.3	2.5
1991	0.8	8.8	2.4
1992	0.8	8.5	2.4
1993	0.7	8.2	2.3
1994	0.7	8.0	2.3
1995	0.7	7.9	2.3
1996	0.7	7.9	2.3
1997	0.7	7.9	2.3
1998	0.7	7.9	2.3
1999	0.7	7.9	2.3

TABLE F-20

SPEED: 45.0 M.P.H. TEMP: 50. (F) % COLD START: 0.0%
MS: 0.803 0.058 0.058 0.045 0.031 0.005 % HOT START: 0.0%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	7.3	40.5	4.9
1971	6.8	37.9	5.0
1972	6.3	35.8	5.1
1973	5.9	33.9	5.1
1974	5.5	32.4	5.0
1975	5.2	30.8	4.9
1976	4.8	29.2	4.8
1977	4.5	27.8	4.6
1978	4.1	26.5	4.4
1979	3.7	25.4	4.3
1980	3.3	23.9	4.1
1981	2.8	22.2	3.9
1982	2.4	20.6	3.7
1983	2.0	18.8	3.5
1984	1.7	16.8	3.4
1985	1.5	15.0	3.2
1986	1.3	13.3	3.0
1987	1.1	12.0	2.8
1988	1.0	10.8	2.6
1989	0.9	9.9	2.5
1990	0.8	9.3	2.5
1991	0.8	8.8	2.4
1992	0.8	8.5	2.4
1993	0.7	8.2	2.3
1994	0.7	8.0	2.3
1995	0.7	7.9	2.3
1996	0.7	7.9	2.3
1997	0.7	7.9	2.3
1998	0.7	7.9	2.3
1999	0.7	7.9	2.3

TABLE F-21

SPEED: 45.0 M.P.H. TEMP: 75. (F) % COLD START: 0.0%
MS: 0.803 0.058 0.058 0.045 0.031 0.005 % HOT START: 0.0%

AVERAGE VEHICLE EMISSION FACTORS (GM/MI)

CY	HC	CO	NOX
1970	7.3	40.5	4.9
1971	6.8	37.9	5.0
1972	6.3	35.8	5.1
1973	5.9	33.9	5.1
1974	5.5	32.4	5.0
1975	5.2	30.8	4.9
1976	4.8	29.2	4.8
1977	4.5	27.8	4.6
1978	4.1	26.5	4.4
1979	3.7	25.4	4.3
1980	3.3	23.9	4.1
1981	2.8	22.2	3.9
1982	2.4	20.6	3.7
1983	2.0	18.8	3.5
1984	1.7	16.8	3.4
1985	1.5	15.0	3.2
1986	1.3	13.3	3.0
1987	1.1	12.0	2.8
1988	1.0	10.8	2.6
1989	0.9	9.9	2.5
1990	0.8	9.3	2.5
1991	0.8	8.8	2.4
1992	0.8	8.5	2.4
1993	0.7	8.2	2.3
1994	0.7	8.0	2.3
1995	0.7	7.9	2.3
1996	0.7	7.9	2.3
1997	0.7	7.9	2.3
1998	0.7	7.9	2.3
1999	0.7	7.9	2.3

APPENDIX G

Methodology for Calculating Cumulative Mileage

Methodology for Calculating Cumulative Mileage

The tables numbered -2, -3, and -4 in each chapter of this document present the emission factors for calendar years 1970 through 1995. For each calendar year, model-year specific emission factors are presented for the 20 most recent model years.

The emission factors for a given model year are assumed to vary linearly with mileage. Since the emission factors for a given model year vehicle are calculated for July 1 of each calendar year it is necessary to know the average cumulative mileage on July 1 of each calendar year.

The cumulative mileages are presented in Tables I-5a, II-5c, II-5d, III-5a,IV-5a, and V-5a.

The methodology for calculating average cumulative mileage will be explained by reference to a specific example: calculation of the average cumulative mileage for a 1978 model year vehicle on July 1 of 1978, 1979, 1980, and later years.

First, we will calculate the average cumulative mileage of a 1978 MY LDV on July 1 of 1978, the calendar year when the vehicle age is defined as 1 year.

We assume that the vehicle sales distribution is constant throughout the year, that the rate of mileage accrual is constant throughout the year, and that the 1978 sales year begins on October 1, 1977.

Using these assumptions, it is obvious that by July 1, 1978 (3/4ths of the way through the sales year) approximately 75% of the 1978 model year vehicles have been sold. These vehicles range in age from 0 to 9 months. Assuming a constant sales distribution, their average age is 4.5 months.

Therefore, the average mileage accrual for these 1978 MY vehicles which have been sold by July 1, 1978 is 4.5/12, or .375 times the annual rate of mileage accrual for the first year. The annual rates of mileage accrual are presented in Tables I-5 through V-5 for each vehicle type. For LDVs the annual mileage accrual rate for vehicles during their first year is 15900 miles.

By July 1, 1979, those vehicles that had been sold by July 1, 1978 have been on the road for an additional year. Therefore, those vehicles have accumulated mileage for 1+(4.5/12) years, or 1.375 years. Referring to Table I-5 for the annual rates of mileage accrual, we can calculate the average cumulative mileage of these vehicles as the sum of the first year's mileage, 15900, plus .375 times the 2nd year annual rate of 15000 miles.

In addition to the 1978 model year vehicles sold before July 1, 1978, we must consider those 1978 MY vehicles sold between July 1, 1978 and Sept. 30, 1978. If we are again assuming a uniform sales distribution, then by July 1, 1979 these vehicles range in age from 9 months to 12 months, and they have an average age of 10.5 months. Since these vehicles are still in their first year of use on July 1, 1979, their average mileage accumulation on that date is 10.5/12, or .875, times 15900 miles.

The average cumulative mileage of all 1978 MY vehicles on July 1, 1979 is the weighted average of the cumulative mileages for these two groups of vehicles (those sold before July 1 and those sold after July 1).

Since the first group represents 9 months of sales and the second group represents 3 months of sales, the weighted average cumulative mileage of 1978 MY vehicles on July 1, 1979 can be expressed as follows:

$$(3/4)(15900 + (.375)15000) + (1/4)((.875)15900)$$

By extension, the formula for the cumulative mileage of 1978 model year vehicles on July 1, 1980 is given by:

$$(3/4)(15900 + 15000 + (.375)14000) + (1/4)(15900 + (.875)15000)$$

and so on.

Denoting the average rate of mileage accumulation during the first, second, and third years as v1, v2, and v3, we can generalize the equations for cumulative mileage on July 1 as follows:

FIRST YEAR: $(.375)v1$

SECOND YEAR: $(3/4)(v1 + (.375)v2) + (1/4)((.875)v1)$

THIRD YEAR: $(3/4)(v1 + v2 + (.375)v3) + (1/4)(v1 + (.875)v2)$

and so on.

For vehicles whose sales year begins on January 1 (heavy duty trucks and motorcycles) the formulas are modified as follows:

FIRST YEAR: (1/4)v1

SECOND YEAR:(1/2)(v1 + (1/4)v2) + (1/2)((3/4)v1)

THIRD YEAR: (1/2)(v1 + v2 + (1/4)v1) + (1/2)(v1 + (3/4)v2)

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